SUDBURY ENVIRONMENTAL STUDY

AN ANALYSIS OF THE IMPACT OF INCO EMISSIONS ON PRECIPITATION QUALITY IN THE SUDBURY AREA

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Ministry
of the
Environment
Ontario

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AN ANALYSIS OF THE IMPACT OF INCO EMISSIONS ON PRECIPITATION QUALITY IN THE SUDBURY AREA

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SYNOPSIS

Conclusions:

The main conclusions of this report may be summarized as follows, with the caution that they should be regarded as tentative until the full data base becomes available:

(1) The relative contribution of INCO emissions to the total wet-deposition of acids, sulfur, and a number of ions and trace metals in the Sudbury area (i.e., within about 50 km of the smelter) is small (with the exception of copper and nickel) - in the order of 10 to 20% - and depends on the weather system passing through the area. Warm fronts generally bring with them polluted air masses from Southern Ontario and the Eastern United States, and for acids, sulfur, and a number of trace metals, the INCO contribution appears to be about 10% of the total. For cold fronts, the percentage contribution from INCO is roughly twice as great. For copper and nickel, the smelter contribution appears to be roughly 40% of the total wet-deposition, regardless of the type of weather system. Note that these estimates of the relative contribution of INCO are based on the level of smelter emissions which occurred during the study period (see Table 9 of the report).

(2) Nevertheless a definite influence of the smelter plume on the local downwind quality of precipitation can be detected, especially for sulfates and trace metals. The smelter impact on precipitation acidity is less pronounced.

(3) During rainstorms, most particulate constituents (acids, sulfates, trace metals) are removed quite efficiently from the smelter emissions. Typically, 50% or more of these constituents may be removed within 50 km on the average rainy day. The percentage of the emitted sulfur that is removed by precipitation is much lower, mainly because this sulfur is largely in the form of sulfur dioxide which is subject to a low precipitation scavenging efficiency.

Introduction:

This is one of several reports prepared by the Ministry of the Environment about the impact of the Sudbury smelter emissions on the Sudbury basin and more distant areas, such as Muskoka-Haliburton. Various data analysis approaches have been taken in these reports, including a comparison of precipitation acidity, and bulk deposition, during the smelter operating and shutdown periods (see references 1 and 4 in the report). The present report concentrates on a detailed meteorological analysis of precipitation events which occurred when the INCO smelter was in operation, thus yielding certain quantitative conclusions about the smelter's impact which are not possible from a comparison of operating and shutdown period data alone. Both wet deposition and precipitation concentration of a number of substances are considered, because the aquatic environment responds primarily to deposition, while concentration may be more relevant to the terrestrial system. Data analysis is focussed on five areas: 1. An evaluation of background concentrations (long range transport component into the region) associated with different types of frontal passage. 2. The relative contribution of local and distant sources to the local precipitation quality. 3. The dependence of pollutant concentration in precipitation on distance from the source due to the interaction of plume and precipitation. 4. The deposition pattern of INCO emitted pollutants. 5. The contribution of local emissions to total wet deposition in the Sudbury area.

An analysis is carried out on precipitation samples from 31 events in August and September, 1978 and from June to October,1979, collected largely within a 50 km radius of the INCO smelter. At the time of writing, the above periods included most of the chemically analysed data available from the Sudbury Environmental Study's event precipitation sampling network with INCO in operation (there was a lengthly shutdown due to a strike at the smelter from Sept. 15, 1978 to June 4, 1979). The results are thus of a preliminary nature, since the collection and chemical analysis of samples is still in progress. For example, deposition by snow or convective storms is not considered at all. Final conclusions will only be possible when the full data base becomes available later this year, and will be reported in November of 1980.

Analysis Summary:

It became evident quite early in the analysis that the composition chemistry of a particular precipitation sample is largely determined by two factors: the type of weather system with which the precipitation is associated, and whether or not the sample is collected downwind of the smelter during the event under consideration.

The weather system is important because warm frontal precipitation is associated with air masses that have crossed industrialized urban areas of Southern Ontario and Eastern United States, whereas cold frontal passages are usually accompanied by the influx of relatively clean air from Northern Canada. Table S1, for example, summarizes some differences in background precipitation chemistry for the 31 events under study.

Table S1^{++}: Mean Background Concentration

(except for pH, all units in mg/l)

Type of Front	pH*	SO_4*	NO_3*	NH_4*	Fe*	Cu	Ni	Pb*	Zn
Warm	4.2	4.8	0.61	0.61	0.039	0.0031	0.0014	0.012	0.015
Cold	4.6	1.4	0.21	0.25	0.022	0.0040	0.0016	0.0065	0.013

The averages shown in the above table were obtained from precipitation samples which were clearly identified as not interacting with smelter emissions. An asterisk identifies those parameters for which there was a statistically significant difference (at the 95% confidence level) between the warm and cold frontal mean concentrations. Note that acids (as indicated by the pH), as well as

[++] Based on Table 3 Of the report

other constituents associated with long-range transport (SO_4, NO_3, Pb), occur at significantly higher concentrations in warm frontal precipitation, whereas species characteristic of smelter emissions (Cu, Ni, Zn) occur at comparable background levels in both warm and cold frontal air masses.

In view of the above results, it is clear that the relative contribution of smelter emissions to the precipitation quality and wet-deposition of many constituents will vary with the type of weather system. The smelter impact on the precipitation quality was determined by carrying out a sector analysis -i.e., by identifying, with the aid of local wind data and other information, those samples downwind of the smelter which could have potentially been affected by smelter emissions during the course of the storm, and comparing their precipitation concentrations with concentrations in the other "background" samples, during the same storm. Table S2 illustrates the average percentage elevation, above background levels, of plume sector sample concentrations for the parameters in Table S1. Note that pH has been converted to H_f, the free hydrogen ion concentration, using the relationship $H_f = 10^{-pH} \times 10^3$ (mg/L).

Table S2[++]: Percentage Elevation (above background) of Average Plume Sector Concentrations

Type of Front	H_f	SO_4	NO_3	NH_4	Fe	Cu	Ni	Pb	Zn
Warm	37	60*	35	33	104*	800*	914*	65*	45
Cold	94*	126*	37	46	144*	627*	894*	98*	60

++ Based on Tables 4 and 5 of the report

As indicated by the asterisks (plume sector concentrations significantly higher than background, at the 95% confidence level), in precipitation samples within the plume sector, the smelter influence is clearly evident for sulfates and most of the trace metals. It is interesting to note that for free hydrogen ions, no statistically significant smelter impact can be detected for the 16 warm frontal events included in the present study.

The sector analysis is extended in the report to examine two additional questions:

(1) What percentage of the smelter emissions are removed by wet deposition within the Sudbury area?

(2) On a longer-term basis, what is the contribution of INCO emissions to the total wet deposition of acids, sulfur, trace metals and other contaminants in the Sudbury basin?

The main results are summarized in Table S3.

Table S3^{++}: Wet Deposition of INCO Emissions Within a 50 km Radius of the Smelter

	Emitted (kg/day)	Deposited (kg/day)	% Emissions Removed	%INCO Contribution to Total Wet Deposition	
				Warm Fronts	Cold Fronts
H_f	$7.2x10^2$	$5.7x10^2$	79	9	21
S	$1.7x10^6$	$1.5x10^4$	0.9	12	31
Fe	$6.1x10^2$	$3.5x10^2$	57	11	18
Cu	$3.3x10^2$	$1.7x10^2$	52	44	38
Ni	$1.4x10^2$	7.1x10	52	42	38
Pb	$3.2x10^2$	$1.0x10^2$	31	10	20
Zn	$1.1x10^2$	$1.3x10^2$	118	11	13

++ Based on Tables 9 and 10 in the report

Regarding the first question, it can be seen from column 4 of the above table that acids and most trace metals are removed very efficiently from the smelter plume. The S emitted by the smelter is predominantly in the form of SO_2, which is expected to have a relatively low scavenging rate - hence the low percentage removal for sulfur. Actually, the values given in Table S3 for percentage of INCO emissions removed within 50 km are probably upper limits, since they are based on the 381 m stack emissions only. Low-level smelter emissions, which also contribute to the wet deposition, should have been added to the 381 m stack values in our calculations, but were not, because they have yet to be quantified properly. It must be pointed out that there is more uncertainty in the deposition rates for H_f and S than for the metals in Table S3, and conclusions about the deposition of these two parameters should be at present regarded as very tentative. It must also be pointed out that Table S3 shows the percentage of the smelter emissions removed by wet deposition on the 31 days under consideration during which it was raining. If an estimate of the corresponding annual average percentage is desired, the values in column 4 must be modified, since it does not rain on every day of the year. An approximate annual average percent removal can be obtained by assuming that precipitation falls every third day, and then multiplying the corresponding numbers in column 4 by one-third. The reader should also be cautioned that this report considers wet deposition only. Smelter emissions will be also removed by other processes not considered here, such as dry depositon, so the figures in Table S3 should not be used to estimate the percentage of the INCO emissions which are not removed, and leave the study area as long-range transport.

Turning now to the contribution of INCO emissions to the total deposition in the study area, column 5 of Table S3 shows that, for warm frontal storms, the smelter contributes in the order of 10% of the total deposition for most of the parameters shown, with the exception of Cu and Ni (where the contribution is considerably greater). For cold frontal storms, the smelter share of the total deposition is roughly twice as great as for the warm frontal cases, except for Cu and Ni (where it is roughly the same). For an average of all types of storms in the Sudbury area, the INCO contribution to the total deposition is expected to be within the range of values shown in Table S3 (i.e. about 40% for Cu and Ni, and 10-20% for most other contaminants, including acids).

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1. Introduction

As part of the Sudbury Environmental Study, the Air Resources Branch (ARB) has been very active in precipitation monitoring in the Sudbury area. The primary objective of this program component is to assess the impact of local sources on precipitation quality and to determine the long term wet deposition pattern in the greater Sudbury area.

During part of 1978 and 1979, the local sources, i.e. INCO and Falconbridge, were not operating, either due to scheduled shutdowns or labour disputes. Immediately after the 1978 shutdown period, a preliminary report (1) was published in which the precipitation network data were evaluated in light of the smelter operating conditions. In that report, it was felt that because of the limited data available, definitive conclusions regarding local source impact could not be made. Since then, a large amount of additional data has been collected, and new analysis techniques have been used for assessment of the fate of the local emissions.

In the present report emphasis will be given to data collected during August-September 1978, and during June to October 1979, for periods when both INCO and Falconbridge were operating. The contributions due to background (i.e. long range transport) and local sources to precipitation quality will be determined and the long term wet deposition pattern in the greater Sudbury area will be estimated. Discussions will be focussed on the INCO operation. Both concentration and deposition considerations are included in this report, because the concentration may be more relevant to terrestrial affects, while the aquatic environment responds primarily to deposition. However, no attempts are made here to interpret the implications of the established values in terms of effects as this is not the mandate of the Air Resources Branch component of the Sudbury Environmental Study. The results presented here should be regarded as preliminary only since the work involved extrapolation of limited seasonal data to a yearly basis. The full data set will be available when Sudbury Environmental Study (SES) field activities are completed and in the final Sudbury Environmental Study Report (scheduled for November of 1980), refinements in the analysis will be made, together with a discussion of effects of the Falconbridge source.

2. The Networks

2.1 History, Objectives and Instrumentation

Two different precipitation monitoring networks have been operated in the Sudbury area as part of the Air Resources Branch committment to the Sudbury Environmental Study.

The first- a cumulative precipitation monitoring network-was designed to assess the long term, large scale, wet deposition field of various substances in the Sudbury area. The network consists of 18 Sangamo Type A wet-only-deposition collectors and 4 Aerochem Metric wet-only collectors. These samplers are distributed throughout the region within a radius of 125 km from Sudbury. The location of the sites can be seen in Figure 1. Sampling began in December of 1977 with ten stations and expanded to its full compliment in mid-1978. The network has operated typically on a monthly collection basis. No further reference will be made in this report to the cumulative network since the balance of this report deals solely with data from the second network. The cumulative network is described here only to provide a brief overview of the entire precipitation monitoring program of the Air Resources Branch. Results of this network will be presented in a future Sudbury Environmental Study report.

The second network is an event precipitation sampling network. It was designed with the objective of assessing the relative impact on local precipitation quality of local as well as more distant sources. Sample collection is carried out on a twenty four hour event basis. Samplers are concentrated primarily within a radius of 50 km from Sudbury. The network was started in late June of 1978. Throughout its operation the number and location of samplers has varied considerabley. Typically 20 to 25 samplers have been operated during the summer months and 10 to 15 during the winter. A summary of the period of operation of all samplers is given in Figure 2. Actual sampling locations (except for the distant samplers at Charlton Station, Ramsey, Thessalon and Blind River) are shown on Figure 3.

The instrumentation for the event network is relatively simple. It consists of a wide-mouthed bucket (42.4 cm dia.) mounted approximately one metre above ground level. A new, high-density polyethylene bag is inserted inside the collector daily. This bag provides a clean, untouched container for precipitation collection, and eliminates the need for washing and leaching of the collector. In the summer of 1979, custom-made bags were introduced into the network. These differed from the bags used previously in that they contained a diagonal seal across their width. This seal and the small opening left near one side, formed a funnel when the bag was inserted in the collector, thus minimizing evaporative losses from the sample. An ordinary bag insert (without the seal) was used in the winter.

2.2 Sample Handling

Event samplers are maintained daily. Using disposable plastic gloves, operators change the bag insert at typically 0800 hrs, after which time they remain open for the entire collection period. If no precipitation occurs during the collection period, the bag is discarded. If precipitation does occur, the bag is removed, a bottom corner is cut, and the sample is transferred to two 450 ml polystyrene bottles and one 60 ml polyethylene bottle. The former bottles are submitted for laboratory analysis of major ions while the latter are spiked at the field office with 0.5 ml of 5% nitric acid and submitted for trace metals analysis. A 50 ml aliquot is taken for "field" pH measurement. Any excess sample is measured for volume and discarded.

At sampling locations not staffed by Sudbury Environmental Study personnel, the samples are stored in refrigerators and collected at least once per week. They are then taken to the Sudbury Environmental Study field office where a 50 ml aliquot is taken for "field" pH measurement, the total volume is determined, and the bottles for metals analysis are spiked with nitric acid. All samples are refrigerated and submitted to the Laboratory Services Branch in Toronto once per week.

In the event that the amount of precipitation collected is less then 1.05 litres, definite sample handling criteria are followed to obtain the most useful information from the limited sample. These criteria are summarized in Appendix 1.

2.3 Chemical Analysis

The Precipitation samples are submitted for chemical analysis to the Laboratory Services Branch of the Ontario Ministry of the Environment in Toronto. Samples stored in the polystyrene bottles are analyzed for: pH, acidity, SO_4, NO_3, NH_4, Ca, Na, K, Mg, Cl, F; and the samples from the acidified polyethylene bottles for Fe, Ni, Cu, Pb, Zn, Al, Cr and Cd. The samples are not filtered prior to analysis. Conductivity is also measured to check the ionic balance. The analysis methods used are summarized in Table 1 together with their corresponding detection limits. Concentrations of NO_3 and NH_4 are expressed as $N\text{-}NO_3$ and $N\text{-}NH_4$. In the beginning of the sampling program, samples were analyzed also for Br and Si, however these were later deleted from the parameter list because they were consistently below detection limits. Note also that in many of the samples identified in the present report as "background", Cu and Ni occurred at concentrations below the detection limits of the analysis method used. In these cases, the data in Appendix 2 were given as being at the detection limit (0.001 mg per liter).

It should be pointed out here that pH is a measure of the free acidic component of precipitation due to strong mineral acids (mainly sulfuric and nitric). It is equal to the negative logarithm of the free hydrogen ion concentration (in moles per litre). Total acidity, on the other hand, which is related to the total hydrogen ion, is a measure of the capacity of the precipitation sample to neutralize base, and is made up of the contribution due to strong acids, weak acids (carbonic acid, organic acids), hydrolyzable metallic salts, etc.

Free hydrogen ion H_f and total hydrogen ion H_t concentrations (in mg per liter) can be calculated according to the following expressions:

$$\left[H_f^+\right] = 10^{-pH} \times 10^3$$

and

$$\left[H_t^+\right] = \text{Acidity (in mg Ca } CO_3 \text{ per liter) } /50$$

2.4 Quality Control

2.4.1 Sample Screening

Integrity of the event precipitation data is guaranteed by a three-step quality control program, viz:

1. Collected precipitation samples which have been contaminated by visible organic material or particulates are discarded immediately.
2. Results of the chemical analysis are screened manually before being placed in the data base. They are divided into two subsets according to the quality of the data. Details of the criteria for categorizing the data are given in Table 2.
3. Data from the two data base subsets are further evaluated for quality in light of the data from all other station samples collected during the same individual events.

Specific details of the third step are given below in Section 2.4.2..

All accepted data are placed in the SES data base with appropriate comments (for later evaluation on an event basis).

2.4.2 Data Screening

Placement of data in the "problem data" category does not necessarily eliminate it from further use. If it can be shown that during a given event, the data for some of the chemical parameters in a particular "problem" sample are reasonable, they will be accepted. However close scrutiny is required before the data will be accepted. Similarly, data in the "accepted data " set may not necessarily be included in final calculations.

In general, the following criteria have been used in the data screening process.

1. Data corresponding to the upper 2% range are singled out initially as outliers. They may be included in the final analysis provided that this does not change the overall pattern during particular events.
2. Most of the data associated with sample volumes less than approximately 140 ml (1 mm depth) were not included in the analysis. Concentrations for these samples were generally very high, which may be partly due to genuine effects (e.g., different scavenging mechansims in light precipitation), and partly to the relatively greater importance of errors due to evaporative losses, dryfall contributions, and sample-container interactions in low-volume samples. Our understanding of these phenomena is not sufficient to enable a proper interpretation of the data in the light of plume vs. background effects.
3. In the assessment of plume impact on local precipitation quality, a sector of precipitation affected by the plume has to be defined and this selection process will be discussed in Section 3.2.2. After determining the plume sector, data from stations falling within and outside of the sector are evaluated separately for consistency. Due

to possible contamination problems which might not have been recognized before sample submission, atypical data which would result in an anomalous pattern are deleted-e.g. a single extremely high concentration value among other low ones outside the plume sector may be due to contamination associated with site specificities, or to chemical analysis errors.

3. Results and Discussion

3.1 Data Presentation

Following the procedures to be discussed in later sections, thirty-one events, each consisting of data from at least 3 stations, were selected from periods when both INCO and Falconbridge were in operation. These events include samples from August to September, 1978 and from June to October, 1979. These are primarily summertime events and the raw data can be found in Appendix 2.

3.2 Data Analysis Approach

In the preliminary analysis of the 1978 shutdown data (1), it was concluded that (a) the temporal and spatial variability of precipitation pH and acid loading in the Sudbury area can be very large, (b) there is a significant acid loading due to precipitation in the Sudbury area, which can only be attributed to long range transport and (c) final conclusions regarding the impact of smelter emission on precipitation chemistry in the Sudbury area will have to await a more detailed meteorological analysis as well as an examination of supplementary data (e.g. trace metal concentrations). A number of these additional analyses will be disscussed in this report.

It has become quite apparent that the background contribution of wet deposition due to long-range transport is not only large, but also varies with the origin of the air mass arriving in the Sudbury area. It was found that in order to assess the smelter contribution relative to that of the imported materials, events had to be first classified according to whether they were associated with warm or cold frontal passages. Sector analysis then singled out samples which were probably affected by local sources during particular events under consideration. The data for both the meteorological stratification and sector analysis are summarized in Appendix 3.

3.2.1 Meteorological Stratification

Information regarding frontal passages was extracted from 6-hour synoptic weather maps. Many events were examined. Some are quite straightforward in terms of classification into cold or warm frontal passages. Others, with the low pressure system centred in the Sudbury area, are somewhat ambiguous because they generally correspond to complicated multiple front or occluded frontal situations. This is reflected in drastically different background concentrations of samples collected in different sectors (or directions) within the network area. Only 31 events for which distinct meteorological assignment of frontal passage could be made (out of a total of 52 events during the study period) are included in this evaluation. In Appendix 3, events are designated numerically according to the sequence of sampling dates. Some pertinent information regarding precipitation time, amount and type is also listed. The above information and wind directions are extracted from hourly surface weather records at Sudbury airport (ground level) and the MOE meteorological tower (250 ft. level).

3.2.2 Sector Analysis

In general, there are two ways to sample precipitation for purposes of source impact evaluation. One involves placing samplers directly underneath the plume once its position is located. Another is to place samplers in a pre-set pattern with subsequent stratification of the sample to identify the plume contribution. The former is a more direct method. However, it is labor intensive and can become very expensive if designed to include a significant number of different storm types. The latter approach is somewhat indirect but is logistically simpler, and was chosen for the present long-term study.

Network design therefore dictates that a careful stratification of samples, according to whether they could be potentially affected by the plume or not, be made before meaningful statistics can be obtained. In selecting the plume sector the most important criterion used was that the sector had to be downwind of the source (as indicated by the surface and upper-level winds). In addition, the plume sector was verified by examining the data for some of the following characteristics:

1. The SO_4, Ni or Cu precipitation concentration (or the SO_4/NO_3 ratio) was seen to be elevated.
2. Continuous SO_2 monitors (operated by the NE Region) near some of the samplers, recorded elevated SO_2 concentrations during the storm.

Generally, samplers identified by elevated SO_4, Ni, Cu or SO_2 concentrations were also within the plume sector established on the basis of the wind data alone.

The final sectors selected are summarized in the 11th column of the Tables in Appendix 3. They correspond to the area potentially affected by the plume, and should not be confused with the actual physical width of the plume since, during a particular event, the plume may have been meandering over a considerable area due to wind shifts. Usually the sectors are less than 120° wide. Some examples of plume sectors are shown in figures 4 and 5.

3.3 Data Interpretation

After following the two-step process in establishing the frontal passage and plume sector, the data were examined for the following:

1. An evaluation of background concentrations (i.e. the long range transport component into the region) associated with different types of frontal passage.
2. The relative contribution of the local and distant sources to the local precipitation quality.
3. The dependence of precipitation concentration due to the local source as a function of distance from the INCO source.
4. The deposition pattern of INCO emitted pollutants.
5. The contribution of local emissions to total wet deposition in the Sudbury area.

The following sections include both data analysis methods and findings based on the 31 summer/autumn events.

3.3.1 Background Component Evaluation

Based on the 31 events selected for discussion in this report, wind roses for both the cold and warm fronts were determined. It was found that during warm frontal passages, the most prevalent wind directions were southerly and southwesterly, whereas for the cold frontal cases, the predominant directions were northwesterly and northerly with a smaller southerly component.

By grouping the concentration data outside the plume sector for the warm and cold frontal passages, the statistics in Table 3 were obtained. The first column gives the parameter of interest. The fourth and seventh columns show the number of events used in the calculations. The second and fifth columns give the average concentrations based on area means associated with individual events. The third and sixth columns give the corresponding one standard deviation for the warm and cold frontal cases respectively. The eighth column indicates the ratio of the average cold and warm frontal background concentrations and the last column is a summary of the student-t statistics (a normal distribution of the parameters was assumed). For the sample size used in our calculations any $t \geq |2.06|$ corresponds to a statistically significant difference between the two types of frontal passage at a 95% confidence level. Several observations are quite apparent:

1. The acid-base equilibrium related parameters, eg. H_f (free hydrogen ion), Ht (total hydrogen ion expressed as acidity) SO_4, NO_3 and NH_4, and F are quite different for the precipitation samples associated with the two types of frontal passage. This reflects the different origins of air masses associated with warm and cold fronts. For warm fronts, the air masses generally pass over the highly industrialized NE United States and Southern Ontario before arriving at the study area. For cold fronts, the origin of the air masses is generally northern Canada.
2. Most heavy metal concentrations are not statistically significantly

different for the two types of frontal situations.

3. In the case of Pb and Cd the difference between background concentrations associated with the two frontal types is statisically significant, suggesting that long range transport of Pb and Cd may be significant. This is in accord with the size characteristics of Pb, and Cd which are primarily associated with fine particles of mass median diameter less than 1 um. Hence, like sulfates, they have a relatively long atmospheric residence time.
4. Other parameters such as Ca, Fe and Al, which are soil-related, exhibit statistically significant differences at the 95% confidence level for the two types of fronts. This may be a reflection of differing wind speeds, and hence re-entrainment of dust, during cold and warm frontal passages.

3.3.2 Relative Impact of Local and Imported Components to Local Precipitation Quality

Concentration data are grouped according to sampling date and frontal passage, and are tabulated in Appendix 4.

Note that the EXSS (i.e. additional) concentration in Appendix 4 is NOT calculated by subtracting the overall mean background concentration from the mean plume sector concentration. Rather, for each individual event, the mean background concentration is subtracted from the concentration of each sample within the plume sector and these differences are then averaged to obtain the mean additional plume sector concentration for that particular event. In some cases (less than 5% of the data), the above subtraction leads to negative values, due to random errors associated with sampling and analysis. These values have no physical significance, and are replaced by zeros. It is felt that this substitution of zeros for negative values is appropriate for parameters associated with smelter emissions, but for those parameters which are primarily due to long range transport and/or local contaminants such as windblown dust (e.g. NO_3, Ca, Mg etc.), the negative values might be real (because of variability in local site characteristics for example).

Therefore the additional concentrations shown for the latter parameters probably overestimate the true plume contribution.

The tables in Appendix 4 reflect the spatial and temporal variabilities of the local precipitation data. For a particular event, the background spatial variability is typically smaller than that seen in the plume sector. This is what one would expect downwind of a point source.

Summary data showing the mean background and plume concentrations for the two types of frontal passage are given in Tables 4 and 5. Also the mean additional concentration, due to interaction of plume with precipitation, calculated according to procedures described above, is given. The ratios of the mean plume concentration to the background concentration are given under heading "B/A" together with the corresponding paired-t statistics. Due to the lower background associated with the cold fronts, their B/A ratios are generally higher than those for the warm frontal cases. The largest ratios of plume to background concentrations are observed in the cases of Cu and Ni. This is not unexpected because of the nature of the smelter emissions. SO_4, and some trace metals, e.g. Fe, Cu, Ni, Pb, and Cd are consistently higher in the plume sector and the differences are statistically significant at the 95% confidence level. The relative magnitude of the additional concentration and background concentration is expressed as C/A in the last column.

In Table 6, additional plume sector concentrations are compared for cold and warm frontal cases. The second to last column in this table gives the ratios for these two. It is noted that for most parameters, e.g. H_f, acidity, Cl, Na, Cu, Ni, Zn and Cd, the additional plume sector concentration differed by less than 20%. In most other cases, the ratios are less than unity, suggesting that there might be higher additional concentrations in the warm frontal cases. For H_f, SO_4, NO_3, NH_4, Pb and F, this could possibly mean that scavenging of plume constituents is more efficient due to the nature of the air mass, which originates from the industrialized south. The results for soil-related materials (e.g. Ca, K, Mg, Fe, and Al), and Cr are not easily explainable, and are being analysed further. The last column is a summary of the paired-t statistics. In none of the cases is the difference between cold and warm front additional plume sector concentrations statistifically significant at the 95% level. This adds credence to the approach used in the remainder of this report -i.e., pooling of warm and cold frontal information for calculating the local source impact.

3.3.3 Dependence of Plume Contributed Concentration on Distance from the INCO Source

Based on the criteria given in Section 3.2.2., plume sectors originating from both the INCO and Falconbridge complexes were established for individual events. In cases where these sectors overlap complications may arise because some sampling stations could have been affected by both sources. Therefore the relative impact due to Falconbridge alone was estimated. Precipitation data obtained from mid-September of 1978 to early June of 1979 (when INCO was on strike) were examined. Due to the sparsity of sampling stations in the vicinity of Falconbridge (especially to the north), the effects of Falconbridge alone on local precipitation could only be assessed in qualitative terms. In general it was found that for equal distance from the two sources, the additional concentration due to Falconbridge alone is typically one-tenth or less of that due to INCO. This is in accord with the relative emission strengths of the two sources. Despite the fact that the relative effect of Falconbridge vs. INCO is small, all the data from samples which could have been affected potentially by both sources were excluded from the assessment of the functional dependence of additional plume concentration on distance from INCO only data designated by "I" and "N" in Appendix 2 are used in the calculations.

Table 7 summarizes the additional concentration due to INCO as a function of distance from the source. Samplers were grouped together according to different distance intervals from INCO-e.g. 3-6 km, 9-11 km, 14-18 km, 21-27 km, 31-32 km and 35-50 km-to obtain the long term average data pattern. Due to that fact that all samples from far downwind distances (e.g. 35-50 km) could be potentially affected by both sources, they were excluded in the analysis. In Table 7, the number of values included in each distance interval is given as "NN" together with the corresponding mean concentration and standard deviation. The mean additional concentrations correspond to the averages of all event additional concentrations in a given interval calculated as described in Section 3.3.2. From these values, it is seen that the variability within the plume sector is quite large even for a single distance interval, mainly due to plume meandering, spatial and temporal variations in the precipitation rate, and changes in the background component from one event to another.

These additional concentration data have been plotted on semi-logarithmic and linear co-ordinates versus distance from INCO. In general, it was found that the data are better represented on logarithmic co-ordinates (see Table 8) and therefore the concentration data are log-transformed before plotting against distance, as in Figures 6 to 24. Each data point in the figure represents the mean of a group of original data points falling within a given distance interval.
In Table 8, both the linear correlation and regression coefficients (according to $Y = \underline{A} + \underline{B}\,X$) are given for logarithmic and linear concentration co-ordinates.

For results which can be reasonably represented by a regression equation, the best fit line is shown in the figure together with the correlation coefficient and regression equation. The results can be categorized into five groups.

1. SO_4 decreases slowly with distance from the source. This may indicate that SO_4 scavenged from the plume is replaced by SO_4 generated from the oxidation of SO_2. Such an effect would require a relatively high $SO_2 \rightarrow SO_4$ oxidation rate under precipitation conditions.

2. Both the H_f and acidity (H_t) patterns are somewhat irregular and may reflect complex acid-base equilibrium relationships, or the

formation of sulfuric acid due to oxidation of SO_2 in the plume.

3. All trace metals concentrations fall off exponentially with distance from the source although the fits for Al and Zn are relatively poor. Using the best-fit regression lines in the figures together with detection limits for our chemical analysis methods, distances beyond which no plume effects can be detected (i.e., where concentrations have fallen to detection limits) were extrapolated from the data. These are also given in Table 8. In general, for metals showing high corrleation coefficients, the data suggest that, on average, the smelter impact does not extend beyond 100 km. It should be stressed that because of the logarithmic nature of the fit, a small fluctuation in the data could lead to a large discrepancy in the distance intercept.
4. Other parameters such as NO_3, NH_4, Ca, Mg, K and Na show irregular patterns and very poor linear correlation coefficients. This is attributed to the randomness associated with long range transport or local contamination of these elements.
5. No explanation can be given for the pattern exhibited by Cl and F.

3.3.4 Long Term Deposition Pattern of INCO Emissions

The additional concentration data discussed in section 3.3.3 were further analyzed to estimate the long term deposition pattern of the INCO emissions in the greater Sudbury area. Attention was focussed on the emittants of major interest i.e. S, Fe, Cu,Ni Pb, Zn and H_f.

Total deposition out to 50 km from INCO was calculated according to the following expression:

$$DEP_{av} = D_{av} \sum_{i=0}^{50\ km} (C_{add} \times A_{plum})\, i$$

where DEP_{av} = average daily deposition through wet scavenging

D_{av} = average daily precipitation depth

C_{add} = average additional concentration due to interaction of plume and precipitation

A_{plum} = plume sector area

From the 31 events included in this report, an average of daily precipitation depth (9mm) was obtained by averaging all the daily mean sample volumes. Also, an average angle of 105^{o} was obtained for the sector width in the 31 events. Using the above data, as well as the regression equations defined in Table 8, the average wet deposition per precipitation day of smelter emissions out to 50 km from the source was calculated. The results are given in column 2 of Table 9 as kg deposited per precipitation day.

It should be noted that the values for sulfur (as sulfate) and free hydrogen ions were not based on the regression equations of Table 8, because the correlation coefficients were quite low. Rather, average additional concentrations of 2.23 mg l^{-1} and 0.0277 mg l^{-1} were used in the calculations. These values were obtained by averaging all the individual additional concentrations of samples collected inside the plume sector from all event days. The original data cover an area defined by a radius of 30 km and therefore the results with extrapolation to 50 km must necessarily be approximate.

In order to estimate the fraction of emitted pollutants that is scavenged by precipitation on a rainy day, average daily emission estimates of these parameters are necessary. There were no in-stack measurements at the INCO 381 m chimney in August-September, 1978 and June-October, 1979. However, SO_2 monthly emission rates (calculated by mass balances) are available. During the study period these ranged from an average of 658 metric tons per day (for July and August, 1978), to a high of 2320 tons per day (for September 1979). From such data, an overall average daily SO_2 emission rate of 1.7×10^{6} kg per day was obtained by weighing the emission rate for each month in our study period by the number of plume sector samples collected during that particular month. The particulate emission rates during the study period could then be estimated using values of particulate - to -SO_2 ratios measured in the INCO plume near the 381 m stack in airborne studies carried out in 1976 and 1977, (2) and again in September, 1979.

Column 3 of Table 9 shows emission rates of the substances of interest, obtained by multiplying their particulate-to-SO_2 ratios by an average SO_2 emission rate of 1.7 X 10^6 kg per day. Also shown in brackets in column 3 are the number of experimental values for the parameter/SO_2 ratio on which the average emission rate is based. Note that emission rates can vary over a wide range, mainly due to process variability (column 4).

From columns 2 and 3 of Table 9, the percentage of each parameter removed on average during each precipitation day by wet deposition out to 50 km from INCO can be estimated. The results are shown in column 5. It must be emphasized that the estimates in column 5 are based on the 31 events reported here, and thus only apply to that subset of days when precipitation was occurring. Since it does not rain on every day of the year, these results must be modified if an estimate of the corresponding annual average percentage is desired. A good approximation can be obtained by assuming that precipitation occurs every third day, and multiplying the numbers in column 5 by one-third to obtain the annual average percentage of emissions removed by wet deposition.

The following observations are of interest:

1. The percentage of the emitted sulfur that is deposited by precipitation within about 50 km of INCO is quite small. This agrees with the results of a study carried out by Wiebe and Whelpdale of the Atmospheric Environment Service some years ago (3).
2. The results for H_f have alreay been qualified above, but it should be further pointed out that due to chemical transformations in the plume, sulfuric acid is probably being continuously formed from SO_2 as the plume travels downwind. Thus, the emissions have a "potential acid content" in excess of the "H_f emission rate" shown in Table 9, i.e. more H_f can be deposited, and this should be kept in mind when considering the value in column 5 for H_f.
3. The percentage of trace metals deposited by precipitation is quite high, suggesting a relatively efficient scavenging process (again, in

agreement with the Atmospheric Environment Service measurements (3)). In fact, for some parameters the percentage of the emissions removed by wet deposition seems suspiciously high, since it generally rained for less than one-third of the 24-hour period in our data set, while emissions continued, of course, for the total period. Admittedly, as indicated by the standard deviations in the emission rates shown in Table 9, there is a considerable uncertainty in the actual emission rates that should have been compared with the measured deposition values, and this could partly explain the results. Furthermore, no account was taken of the low-level emissions from INCO, which have not been properly measured to date, but according to some estimates the particulate emissions could be of the same order of magnitude as those from INCO's 381 m chimney. Since our samplers were exposed to the effects of both 381 m stack and low-level emissions, the total emission rate from both sources should properly be used in computing column 5 of Table 9. Finally despite the fact that precautions were taken to obtain wet-only samples, there is a possibility that some dry deposition may also have occurred during the sampling period, especially if low-level emissions passed over the sampler. The importance of the contribution from this effect is hard to evaluate at present.

3.3.5 Contribution of INCO Emissions to Total Wet Deposition in the Sudbury Area

The data presented in Table 9 are further arranged to yield information on the wet deposition due to local sources relative to the total (local + long range transport) deposition in an area defined by a radius of 50 km from INCO. This was done separately for the warm and cold frontal cases by multiplying the appropriate concentration, area and precipitation depth (9mm). The average plume-affected sector was again assumed to be 105^{o} wide. The mean background concentrations used are those reported in Tables 4 and 5. Table 10 shows the wet deposition due to local sources (taken from column 2 of Table 9), as well as the background contribution. In columns 5 and 6 of this table, the local contribution is expressed as a percentage of the total value. As expected, the relative contribution of local sources is generally higher for events associated with cold frontal passages. Typically, local contribution amounts to less than 20% of the total deposition to the study area, with the exception of Cu and Ni, where the local contribution as high as 45% (-this figure could be even higher, since, as pointed out in Section 2.3, Cu and Ni concentrations in many background samples were assumed to be at the detection limit, whereas in fact they were below the detection limit). Note that the numbers in columns 5 and 6 of Table 10 apply to the level of smelter emissions obtaining during the study period. The smelter contribution to the total wet-deposition at other emission rates would of course be different, and is expected to increase as the emission rate increases. Mathematical models currently being developed as part of the Sudbury Enviromenal Study will lead to more quantiative relationships between smelter emission rates and impact on wet deposition.

In the report published in February, 1979 (1), it was concluded that no statistically significant difference could be found between precipitation concentration and wet deposition of acids measured during the smelter operating and shutdown periods in the summer and autumn of 1978. It was also suggested that most of the acids deposited by precipitation are imported into the region. In that particular analysis, data from the whole area, and unstratified by frontal type or plume sector, were pooled together to arrive at the conclusions. In the present report, data have been stratified according to weather systems and whether or not the samples were affected by the local source. As can be seen from Table 10, the local source contribution to the total wet deposition into an area defined by 50 km amounts to only 9 and 21% for warm and cold fronts respectively. The overall average value, for all types of fronts, would be about 15%. The current findings are thus consistent with the conclusions reported earlier (1). In view of the large variability inherent in precipitation chemistry and wet deposition measurements, and the relatively small smelter contribution over the network, it is not surprising that the background "noise" inherent in the data of the earlier report masked any differences due to smelter operating conditions.

4. Conclusions

In this report, precipitation data collected in Sudbury during a number of events in August and September, 1978 and from June to October, 1979 were examined to assess the impact of the INCO source on local precipitation quality and to determine the resulting wet deposition pattern. Other atmospheric pathways affecting the fate of the emitted pollutants, such as dry deposition and chemical transformation, are not discussed, and therefore the results reported here should not be taken as the only atmospheric fate of the emitted pollutants. Thirty-one summer/autumn precipitation events were examined, and thus the conclusions are based on a data set which is relatively small, and which will be expanded as more samples are collected and analyzed. In order to properly evaluate the impact of the local source on precipitation quality, it was necessary to consider more than one or two parameters (e.g. free hydrogen ion and sulfate) only. Relatively complex analysis techniques, applied to data collected on a long-term basis, had to be developed. The conclusions reported here result from the development of new data analysis techniques which involved both meteorological stratification and sector analysis.

As the results presented here involved extrapolation of limited summer/autumn data to a yearly basis, some of the conclusions (especially for sulfur and acids) may be revised in the future. Nevertheless, the following conclusions were drawn:

- The quality of precipitation in the Sudbury area is highly dependent on the origin of the air mass associated with the precipitation, and this is reflected in differences in background precipitation chemistry for cold and warm frontal passages. Based on the 31 events selected for discussion in this report, it was found that during warm frontal passages, the most prevalent wind directions were southerly and southwesterely, whereas for the cold frontal cases, the predominant directions were northwesterly and northerly with a smaller southerly component. Parameters such as H_f (free hydrogen ions), H_t (total hydrogen ions), SO_4, NO_3, NH_4, F, Pb and Cd have higher concentrations in warm frontal precipitation, and are probably largely imported into the Sudbury area from the Eastern United States and Southern Ontario.

- A preliminary estimate was made of the relative contributions of local sources and long-range transport to wet deposition in the Sudbury area. The contribution of local sources was generally relatively higher on days of cold frontal precipitation than on days of warm frontal precipitation. Expressing the local contribution as a percentage of the total desposition, the following results were obtained: for cold fronts - S, 31%; Fe, 18%; Cu, 38%; Ni, 38%; Pb, 20%; Zn, 13%; H_f, 21% and for warm fronts - S, 12%; Fe, 11%; Cu, 44%; Ni, 42%; Pb, 10%; Zn, 11%; and H_f, 9%. For acids, the present results are not inconsistent with those of an earlier report (1), where no significant difference could be found in precipitation concentrations or deposition in the Sudbury area during smelter operation and shutdown periods due to the large background contribution and the inherent spatial and temporal variability of these parameters.

- In spite of this large background contribution of many chemical parameters, a careful sector analysis of the data reveals a definite influence of smelting activities on local precipitation quality. Samples within the sector affected by the plume show statistically significant increases (over background samples) of acidity, as well as in concentrations of SO_4, Fe, Cu, Ni, Pb and Cd. The additional plume sector concentrations generally range from one-half to twice the background values, and, in the case of Cu and Ni, can be an order of magnitude higher than the background values.

- The additional plume sector precipitation concentration for many trace metals falls off approximately exponentially with distance from the source, approaching chemical analysis detection limit values within 100 km of the source. A different relationship is suggested by the data for H_f, SO_4, and some of the soil-derived parameters, which will have to await a larger data base before it can be clarified.

- The removal of trace metals by precipitation is an efficient process. On days when precipitation occurs, more than 50% of the trace metal emissions can be deposited within 50 km of the source. When compared to annual emissions (taking the precipitation frequency into account) our preliminary estimates for the percentage of INCO - emitted trace metals that are wet-deposited throughout the year within 50 km are: Fe, 19%; Cu, 17%; Ni, 17%; Pb, 10%; and Zn, 39%.

- The wet-removal of the total emitted sulfur on precipitation days is estimated to be considerably smaller - i.e. about 1% (1.5×10^4 kg/day) . On the other hand, for H_f wet-removal is 79% (5.7×10^2 kg/day) within 50 km of the source. It is speculated that these results are due to the much more efficient wet removal of particulate (largely H_2SO_4) than gaseous (SO_2) sulfur from the plume, and possibly also due to the formation of sulfuric acid within the plume. When prorated over an annual basis, the corresponding percentages removed by wet deposition are: S, 0.3%; and H_f, 26%.

5. Future Work

The emphasis of this report was to examine the effects of INCO's operations on precipitation quality in the Sudbury area. Due to the sparsity of data for Falconbridge, its effects were only estimated qualitatively. Future work will include the following refinements and additional analyses:

(1) A quantitative evaluation of the impact of Falconbridge, (which will be possible when additional data become available)

(2) A refinement of the INCO impact analysis.

(3) Estimates of rain and snow scavenging efficiency, for use in SES mathematical models.

(4) A comparison of monthly concentrations and depositions as determined by the event and cumulative networks.

REFERENCES

1. "Analysis of the Sudbury Environmental Study Network Precipitation Acidity Data, June-September, 1978, "Report of Air Resources Branch, Ontario Ministry of the Environment, February, 1979.

2. "Airborne Investigations of the INCO and Falconbridge Stack Plumes, 1976-77" Report No. ARB-TDA 60-79, Air Resources Branch, Ontario Ministry of the Environment, May 1979.

3. Wiebe, H.A. and Whelpdale, D.M., "Precipitation Scavenging from a Tall Stack Plume", Proceedings of the 1974 Precipitation Scavenging Symposium, Champaign, Ill., Oct. 14-18, 1974.

4. "Bulk Deposiiton in the Sudbury and Muskoka-Haliburton Areas of Ontario During the Shutdown of INCO Ltd. in Sudbury", Water Resources Branch, Ontario Ministry of the Environment, May 1980.

Table 1: Details of Precipitation Sample Analyses

Parameter	Analysis Method	Detection Limit (mg l^{-1})
pH (for H_f determination)	Radiometer	± 0.1 pH unit
Total Acidity (for H_t determination)	NaOH titration to pH 8.3; results presented as mg $CaCO_3$ l^{-1}	± 0.08
SO_4	Ion Chromatography	± 0.04*
$N\text{-}NO_3$	Ion Chromatography	± 0.01*
Cl	Ion Chromatography	± 0.04*
F	Ion Chromatography	± 0.04*
$N\text{-}NH_4$	Automated phenate-hypochlorite method	± 0.008
Ca	Flame atomic absorption	± 0.02*
Na	Flame atomic absorption	± 0.02*
K	Flame atomic absorption	± 0.02*
Mg	Flame atomic absorption	± 0.02*
Zn	Flame atomic absorption	± 0.001
Fe	Flameless atomic absorption	± 0.001
Ni	Flameless atomic absorption	± 0.001
Cu	Flameless atomic absorption	± 0.001
Pb	Flameless atomic absorption	± 0.001
Al	Flameless atomic absorption	± 0.005
Cr	Flameless atomic absorption	± 0.0005
Cd	Flameless atomic absorption	± 0.0001

* Values correspond to lowest values reported.

Table 2: Data Subsets and Their Associated Criteria for Categorizing

Problem Data	Accepted Data
1. The absolute difference between field and laboratory measured pH was greater than or equal to 0.4 pH units.	1. Clean, clear, properly collected samples with good chemical analysis results.
2. Obvious contamination was noted but sample was submitted.	2. Visual evidence of slight contamination by an insect or particulates but not both. Analytical results appear reasonable.
3. The sampling period was not within 24 ± 6 hours.	3. Difference between field and lab pH less than 0.4 pH units. In this case, the lab pH value is generally used, except where the field value is obviously more consistent with other, nearby measurements.
4. Contamination of one or more chemical parameters was apparent from chemical analysis results although sample appeared clean.	

TABLE 3 : MEAN BACKGROUND PRECIPITATION CONCENTRATION (MG/L)

MEAN BACKGROUND CONCENTRATION (MG/L)

	WARM FRONT (A)			COLD FRONT (B)				
	MEAN	STDV	NN	MEAN	STDV	NN	B/A	T-T
HF	0.0776	0.0227	16.	0.0289	0.0120	14.	0.37	7.19*
PH +	4.1558	0.1477	16.	4.6220	0.2148	14.	1.11	-7.00*
ACID	6.6296	1.6722	16.	3.2309	0.7202	12.	0.49	6.57*
SO4	4.8058	1.1713	16.	1.4120	0.5218	14.	0.29	9.99*
NO3	0.6064	0.2335	16.	0.2096	0.1476	14.	0.35	5.47*
NH4	0.6068	0.2681	16.	0.2511	0.1126	13.	0.41	4.46*
CL	0.2045	0.1151	16.	0.1549	0.0824	13.	0.76	1.30
CA	0.4532	0.2212	16.	0.1788	0.0948	14.	0.39	4.30*
MG	0.0668	0.0505	16.	0.0453	0.0439	14.	0.68	1.24
NA	0.0726	0.0379	16.	0.0646	0.0442	14.	0.89	0.53
K	0.1066	0.0928	16.	0.0778	0.0621	14.	0.73	0.98
F	0.0396	0.0132	15.	0.0288	0.0137	13.	0.73	2.12*
FE	0.0391	0.0260	16.	0.0223	0.0133	14.	0.57	2.18*
CU	0.0031	0.0019	16.	0.0040	0.0027	14.	1.29	-1.07
NI	0.0014	0.0003	16.	0.0016	0.0006	14.	1.14	-1.18
PB	0.0124	0.0046	16.	0.0055	0.0032	14.	0.44	4.70*
ZN	0.0154	0.0066	16.	0.0125	0.0076	14.	0.81	1.12
AL	0.0280	0.0195	16.	0.0137	0.0098	14.	0.49	2.48*
CR	0.0006	0.0002	16.	0.0008	0.0004	14.	1.33	-1.77
CD	0.0002	0.0001	16.	0.0001	0.0001	14.	0.50	2.73

+ : IN PH UNITS
MEAN : MEAN CONCENTRATION OF DAILY AREA MEANS
STDV : STANDARD DEVIATION
NN : NUMBER OF DATA POINTS (EVENTS)
T-T : STUDENT-T STATISTICS
* : STATISTICALLY SIGNIFICANT AT 95 % CONFIDENCE LEVEL

TABLE 4 : RELATIVE BACKGROUND AND PLUME CONCENTRATIONS ASSOCIATED WITH WARM FRONTAL PASSAGE.

	CONCENTRATION (MG/L)											
	BACKGROUND (A)			PLUME (B)			ADDITIONAL (C)					
	MEAN	STDV	NN	MEAN	STDV	NN	MEAN	STDV	NN	B/A	T-T	C/A
HF	0.0776	0.0227	16.	0.0971	0.0475	13.	0.0284	0.0324	13.	1.25	-1.45	0.37
PH +	4.1558	0.1477	16.	4.0715	0.2180	13.	0.0432	0.0749	13.	0.98	1.24	0.01
ACID	6.6296	1.6722	16.	8.5580	2.9024	11.	1.9248	2.0380	11.	1.29	-2.19*	0.29
SO4	4.8058	1.1713	16.	7.7511	2.2381	14.	2.8667	1.8279	14.	1.61	-4.60*	0.60
NO3	0.6064	0.2335	16.	0.7928	0.3489	13.	0.2108	0.2438	13.	1.31	-1.72	0.35
NH4	0.6068	0.2681	16.	0.8077	0.3745	13.	0.1976	0.3149	13.	1.33	-1.68	0.33
CL	0.2045	0.1151	16.	0.1832	0.0648	13.	0.0305	0.0460	13.	0.90	0.59	0.15
CA	0.4532	0.2212	16.	0.5841	0.4838	12.	0.1714	0.2416	12.	1.29	-0.96	0.38
MG	0.0668	0.0505	16.	0.0724	0.0545	12.	0.0221	0.0285	12.	1.08	-0.28	0.33
NA	0.0726	0.0379	16.	0.0930	0.0640	12.	0.0328	0.0453	12.	1.28	-1.06	0.45
K	0.1066	0.0928	16.	0.0926	0.0818	13.	0.0210	0.0295	13.	0.87	0.43	0.20
F	0.0396	0.0132	15.	0.0415	0.0212	13.	0.0090	0.0123	13.	1.05	-0.29	0.23
FE	0.0391	0.0260	16.	0.0808	0.0479	14.	0.0405	0.0294	14.	2.07	-3.02*	1.04
CU	0.0031	0.0019	16.	0.0281	0.0236	14.	0.0248	0.0237	14.	9.06	-4.23*	8.00
NI	0.0014	0.0003	16.	0.0141	0.0147	14.	0.0128	0.0146	14.	10.07	-3.46*	9.14
PB	0.0124	0.0046	16.	0.0206	0.0081	14.	0.0080	0.0064	14.	1.66	-3.47*	0.65
ZN	0.0154	0.0066	16.	0.0181	0.0074	14.	0.0070	0.0075	14.	1.18	-1.06	0.45
AL	0.0280	0.0195	16.	0.0450	0.0355	14.	0.0200	0.0250	14.	1.61	-1.65	0.71
CR	0.0006	0.0002	16.	0.0006	0.0003	13.	0.0001	0.0003	13.	1.00	0.0	0.17
CD	0.0002	0.0001	16.	0.0004	0.0002	14.	0.0002	0.0002	14.	2.00	-3.53*	1.00

+ : IN PH UNITS
MEAN : MEAN CONCENTRATION OF DAILY AREA MEANS
STDV : STANDARD DEVIATION
NN : NUMBER OF DATA POINTS (EVENTS)
T-T : STUDENT-T STATISTICS
* : STATISTICALLY SIGNIFICANT AT 95 % CONFIDENCE LEVEL

TABLE 5 : RELATIVE BACKGROUND AND PLUME CONCENTRATIONS ASSOCIATED WITH COLD FRONTAL PASSAGE.

CONCENTRATION (MG/L)

	BACKGROUND (A)			PLUME (B)			ADDITIONAL (C)					
	MEAN	STDV	NN	MEAN	STDV	NN	MEAN	STDV	NN	B/A	T-T	C/A
HF	0.0289	0.0120	14.	0.0575	0.0311	15.	0.0272	0.0262	14.	1.99	-3.22*	0.94
PH +	4.6220	0.2148	14.	4.3235	0.2268	15.	0.0261	0.0481	14.	0.94	3.63*	0.01
ACID	3.2309	0.7202	12.	4.8403	1.6983	13.	1.6038	1.3946	12.	1.50	-3.04*	0.50
SO4	1.4120	0.5218	14.	3.2173	1.1189	15.	1.7734	1.1053	14.	2.28	-5.50*	1.26
NO3	0.2096	0.1476	14.	0.2726	0.1566	15.	0.0778	0.0929	14.	1.30	-1.11	0.37
NH4	0.2511	0.1126	13.	0.3225	0.1871	15.	0.1152	0.1130	13.	1.28	-1.20	0.46
CL	0.1549	0.0824	13.	0.1363	0.0653	14.	0.0339	0.0443	13.	0.88	0.65	0.22
CA	0.1788	0.0948	14.	0.2011	0.1060	15.	0.0529	0.0596	14.	1.12	-0.60	0.30
MG	0.0453	0.0439	14.	0.0412	0.0294	15.	0.0153	0.0231	14.	0.91	0.30	0.34
NA	0.0646	0.0442	14.	0.0802	0.0959	15.	0.0355	0.0749	14.	1.24	-0.56	0.55
K	0.0778	0.0621	14.	0.0747	0.0625	15.	0.0371	0.0562	14.	0.96	0.13	0.48
F	0.0288	0.0137	13.	0.0312	0.0130	13.	0.0043	0.0059	12.	1.08	-0.46	0.15
FE	0.0223	0.0133	14.	0.0499	0.0344	15.	0.0321	0.0355	14.	2.24	-2.81*	1.44
CU	0.0040	0.0027	14.	0.0280	0.0237	15.	0.0251	0.0239	14.	7.00	-3.76*	6.27
NI	0.0016	0.0006	14.	0.0151	0.0132	15.	0.0143	0.0131	14.	9.44	-3.82*	8.94
PB	0.0055	0.0032	14.	0.0109	0.0064	15.	0.0054	0.0056	14.	1.98	-2.84*	0.98
ZN	0.0125	0.0076	14.	0.0152	0.0105	15.	0.0075	0.0079	14.	1.22	-0.79	0.60
AL	0.0137	0.0098	14.	0.0164	0.0110	15.	0.0075	0.0105	14.	1.20	-0.70	0.55
CR	0.0008	0.0004	14.	0.0008	0.0006	15.	0.0002	0.0004	14.	1.00	0.0	0.25
CD	0.0001	0.0001	14.	0.0004	0.0003	15.	0.0002	0.0003	14.	4.00	-3.56*	2.00

+	: IN PH UNITS
MEAN	: MEAN CONCENTRATION OF DAILY AREA MEANS
STDV	: STANDARD DEVIATION
NN	: NUMBER OF DATA POINTS (EVENTS)
T-T	: STUDENT-T STATISTICS
*	: STATISTICALLY SIGNIFICANT AT 95 % CONFIDENCE LEVEL

TABLE 6 : ADDITIONAL CONCENTRATION (MG/L)
DUE TO PLUME-PRECIPITATION INTERACTION

	WARM(A)			COLD(B)				
	MEAN	STDV	NN	MEAN	STDV	NN	B/A	T-T
HF	0.0284	0.0324	13.	0.0272	0.0262	14.	0.96	0.11
PH +	0.0432	0.0749	13.	0.0261	0.0481	14.	0.60	0.71
ACID	1.9248	2.0380	11.	1.6038	1.3946	12.	0.83	0.44
SO4	2.8667	1.8279	14.	1.7734	1.1053	14.	0.62	1.92
NO3	0.2108	0.2438	13.	0.0778	0.0929	14.	0.37	1.90
NH4	0.1976	0.3149	13.	0.1152	0.1130	13.	0.58	0.89
CL	0.0305	0.0460	13.	0.0339	0.0443	13.	1.11	-0.19
CA	0.1714	0.2416	12.	0.0529	0.0596	14.	0.31	1.78
MG	0.0221	0.0285	12.	0.0153	0.0231	14.	0.69	0.67
NA	0.0328	0.0453	12.	0.0355	0.0749	14.	1.08	-0.11
K	0.0210	0.0295	13.	0.0371	0.0562	14.	1.77	-0.92
F	0.0090	0.0123	13.	0.0043	0.0059	12.	0.48	1.20
FE	0.0405	0.0294	14.	0.0321	0.0355	14.	0.79	0.68
CU	0.0248	0.0237	14.	0.0251	0.0239	14.	1.01	-0.03
NI	0.0128	0.0146	14.	0.0143	0.0131	14.	1.12	-0.29
PB	0.0080	0.0064	14.	0.0054	0.0056	14.	0.67	1.14
ZN	0.0070	0.0075	14.	0.0075	0.0079	14.	1.07	-0.17
AL	0.0200	0.0250	14.	0.0075	0.0105	14.	0.38	1.72
CR	0.0001	0.0003	13.	0.0002	0.0004	14.	2.00	-0.73
CD	0.0002	0.0002	14.	0.0002	0.0003	14.	1.00	0.0

+ : IN PH UNITS
MEAN : MEAN CONCENTRATION OF DAILY AREA MEANS
STDV : STANDARD DEVIATION
NN : NUMBER OF DATA POINTS (EVENTS)
T-T : STUDENT-T STATISTICS

TABLE 7 : ARC MEAN ADDITIONAL CONCENTRATION(MG/L) & STANDARD DEVIATION DUE TO PLUME CONTRIBUTION.

	(3.- 6.) KM			(9.-11.) KM			(14.-18.) KM			(21.-27.) KM			(31.-32.) KM		
	NN	CONC	STDV	NN	CONC	STDV	NN	CONC	STDV	NN	CONC	STDV	NN	CONC	STDV
HF	28	0.0331	0.0409	19	0.0231	0.0261	10	0.0230	0.0376	17	0.0243	0.0317	19	0.0294	0.0271
ACID	23	1.8960	1.9732	16	1.8300	1.7562	10	2.0571	2.7993	13	1.8432	1.9003	16	1.9154	2.0476
SO4	28	2.3505	1.8931	18	1.7298	1.2346	10	2.2816	1.8629	19	2.0762	1.7368	19	2.0066	1.7889
NO3	27	0.1356	0.2178	18	0.0831	0.0999	9	0.2121	0.2868	17	0.1732	0.2488	18	0.1799	0.2261
NH4	26	0.2359	0.3780	17	0.1030	0.1195	10	0.2173	0.1951	16	0.1692	0.2828	16	0.1583	0.2366
CL	26	0.0247	0.0827	17	0.0062	0.0145	10	0.0613	0.0713	17	0.0545	0.1111	18	0.0346	0.0652
CA	25	0.0519	0.0965	18	0.0247	0.0410	7	0.1885	0.2754	13	0.1060	0.2118	16	0.1485	0.2716
MG	27	0.0190	0.0294	18	0.0072	0.0231	8	0.0164	0.0308	16	0.0194	0.0353	14	0.0109	0.0217
NA	26	0.0268	0.0686	17	0.0075	0.0167	10	0.0383	0.0389	14	0.0227	0.0469	15	0.0259	0.0459
K	24	0.0029	0.0084	18	0.0510	0.1043	10	0.0690	0.0926	14	0.0245	0.0536	15	0.0156	0.0327
F	24	0.0108	0.0207	17	0.0053	0.0069	9	0.0049	0.0133	15	0.0059	0.0093	16	0.0065	0.0120
FE	25	0.0734	0.0710	19	0.0341	0.0478	9	0.0548	0.0653	17	0.0194	0.0253	16	0.0150	0.0178
CU	27	0.0775	0.0838	20	0.0243	0.0223	9	0.0212	0.0170	18	0.0153	[illegible]	17	0.0039	0.0047
NI	27	0.0382	0.0455	20	0.0129	0.0111	9	0.0106	0.0163	18	0.0070	0.0107	17	0.0012	0.0024
PB	26	0.0143	0.0171	19	0.0050	0.0053	9	0.0100	0.0071	17	0.0060	0.0073	16	0.0046	0.0056
ZN	26	0.0066	0.0078	19	0.0109	0.0170	9	0.0088	0.0123	17	0.0063	0.0169	16	0.0062	0.0143
AL	26	0.0164	0.0314	19	0.0090	0.0166	9	0.0142	0.0285	17	0.0085	0.0096	16	0.0139	0.0218
CR	26	0.0004	0.0010	18	0.0002	0.0006	9	0.0001	0.0002	17	0.0000	0.0001	14	0.0000	0.0001
CD	25	0.0006	0.0008	19	0.0002	0.0002	9	0.0002	0.0002	17	0.0003	0.0003	16	0.0001	0.0001

NN : NUMBER OF DATA POINTS (EVENTS)
CONC : MEAN CONCENTRATION
STDV : STANDARD DEVIATION

TABLE 8 : CORRELATION AND REGRESSION COEFFICIENTS FOR MEAN ADDITIONAL CONCENTRATION AND DISTANCE.

		LINEAR		LOG		LINEAR		LOG	
	DTL	COR1	DIS1	COR2	DIS2	AAA1	BBB1	AAA2	BBB2
HF	0.0025	-0.14	419.	-0.11	1487.	0.02762	-0.00006	-1.56810	-0.00070
ACID	0.0800	0.05	-4233.	0.06	-13305.	1.90094	0.00043	0.27850	0.00010
SO4	0.0400	-0.21	445.	-0.16	2149.	2.17142	-0.00479	0.33127	-0.00080
NO3	0.0100	0.55	-41.	0.55	-128.	0.11337	0.00252	-0.96505	0.00811
NH4	0.0080	-0.26	152.	-0.13	768.	0.19832	-0.00125	-0.73948	-0.00177
CL	0.0400	0.45	21.	0.48	26.	0.02027	0.00093	-1.85652	0.01778
CA	0.0200	0.61	-5.	0.66	-11.	0.03801	0.00383	-1.46483	0.02213
MG	0.0200	-0.11	-85.	-0.03	-276.	0.01551	-0.00005	-1.85438	-0.00056
NA	0.0200	0.18	-6.	0.27	13.	0.02111	0.00018	-1.78332	0.00665
K	0.0200	-0.08	77.	0.26	16.	0.03621	-0.00021	-1.90654	0.01308
F	0.0400	-0.47	-301.	-0.40	-140.	0.00846	-0.00010	-2.10785	-0.00505
FE	0.0010	-0.85	37.	-0.89	80.	0.07251	-0.00193	-1.06400	-0.02420
CU	0.0010	-0.83	30.	-0.95	48.	0.06633	-0.00220	-1.01892	-0.04108
NI	0.0010	-0.86	29.	-0.95	37.	0.03341	-0.00113	-1.24700	-0.04775
PB	0.0010	-0.69	43.	-0.68	82.	0.01258	-0.00027	-1.91159	-0.01331
ZN	0.0020	-0.47	82.	-0.48	137.	0.00928	-0.00009	-2.03873	-0.00481
AL	0.0050	-0.23	118.	-0.19	189.	0.01366	-0.00007	-1.88312	-0.00221
CR	0.0005	-0.89	-6.	-0.97	3.	0.00041	-0.00001	-3.16053	-0.05207
CD	0.0001	-0.70	30.	-0.75	31.	0.00051	-0.00001	-3.24543	-0.02454

DTL : DETECTION LIMIT (MG/L) EXCEPT FOR HF WHICH IS EQUIVALENT TO THAT OF 'CLEAN PRECIPITATION' (PH=5.6).
COR : CORRELATION COEFFICIENT
DIS : DISTANCE AT WHICH CONCENTRATION EQUALS TO DETECTION LIMIT (KM)
AAA : REGRESSION COEFFICIENT 'A'
BBB : REGRESSION COEFFICIENT 'B'

Table 9: Estimated Wet Deposition, Emission Rates and % of INCO 381 m Stack Emissions Removed at 50 km.

Parameter	*Wet Deposition (kg/day)	Emission Rate+ (kg/day)	Std. Dev. in Emission Rate	Average % Emissions Removed out to 50 km on days when it was raining
S	1.5×10^4	1.7×10^6	n.a.	0.9
Fe	3.5×10^2	6.1×10^2 (10)	5.6×10^2	57
Cu	1.7×10^2	3.3×10^2 (16)	3.8×10^2	52
Ni	7.1×10^1	13.7×10^1 (14)	12.4×10^1	52
Pb	1.0×10^2	3.2×10^2 (8)	0.94×10^2	31
Zn	1.3×10^2	1.1×10^2 (12)	1.1×10^2	118
H_f**	5.7×10^2	7.2×10^2 (29)	4.0×10^2	79

* Precipitation days only.

** Estimated by assuming that all of the particulate sulfur emitted is in the form of H_2SO_4.

+ Values in brackets correspond to the number of particulate-to-SO_2 data points used in calculations.

Table 10: Contribution of INCO Emissions to Total Wet Deposition in the Sudbury Area (r=50 km)

		Background Deposition (kg/Day)		% Relative Depostion (Local/Total)*	
Parameter	Local Sources Deposition (kg/Day)	Warm Front	Cold Front	Warm Front	Cold Front
S	1.5×10^{4}	11×10^{4}	3.3×10^{4}	12	31
Fe	3.5×10^{2}	28×10^{2}	16×10^{2}	11	18
Cu	1.7×10^{2}	2.2×10^{2}	2.8×10^{2}	44	38
Ni	7.1×10^{1}	9.7×10^{1}	11.7×10^{1}	42	38
Pb	1.0×10^{2}	8.9×10^{2}	3.9×10^{2}	10	20
Zn	1.3×10^{2}	11×10^{2}	8.9×10^{2}	11	13
H_f	5.7×10^{2}	55×10^{2}	21×10^{2}	9	21

* Total wet deposition represents the summation of local plus background deposition.

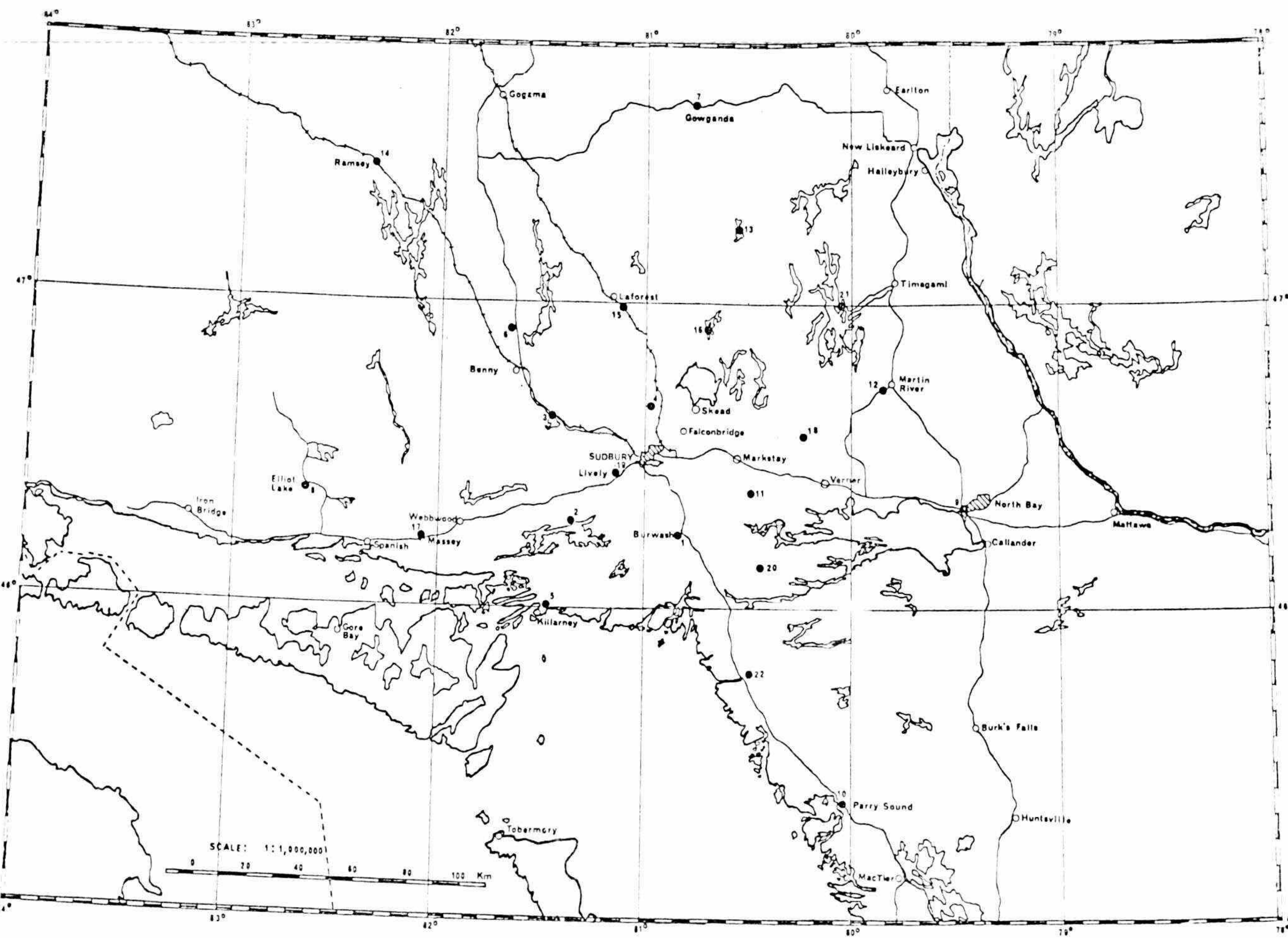
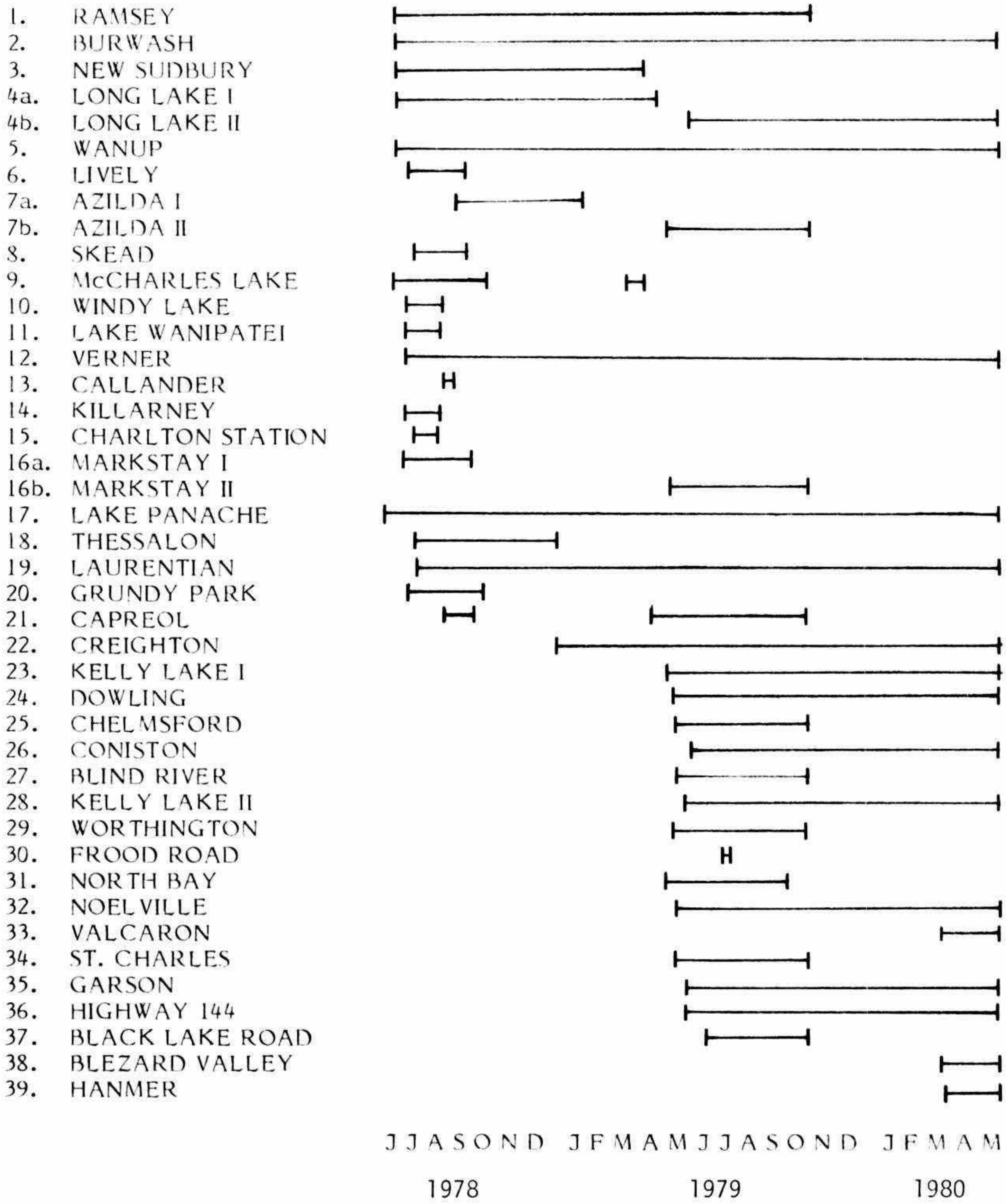


Figure 1: SES Cumulative Precipitation Sampling Network

FIGURE 2: A SUMMARY OF SES EVENT PRECIPITATION SAMPLER OPERATING PERIODS



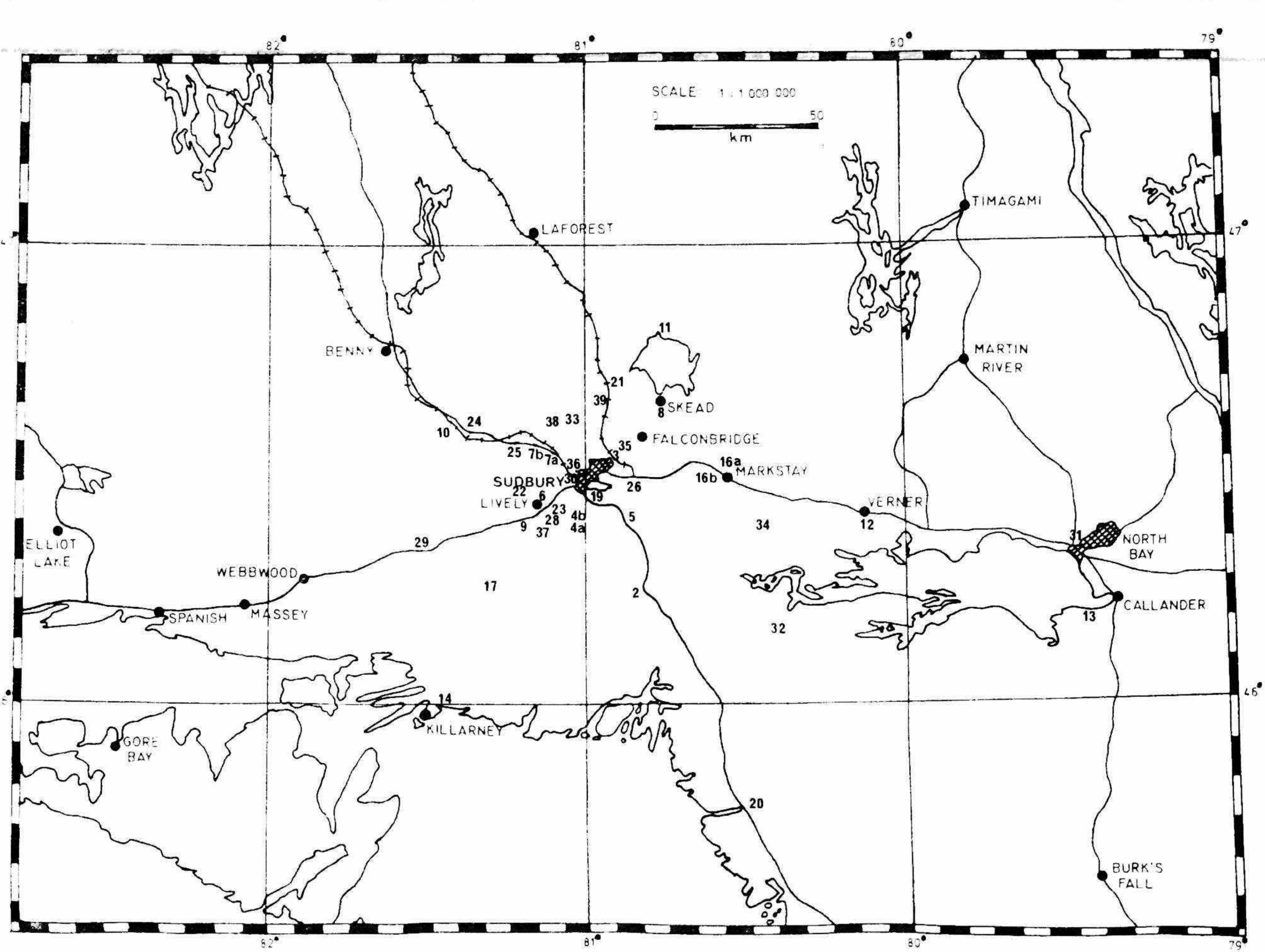


Figure 3: SES Event Precipitation Sampling Network (1978-1980)

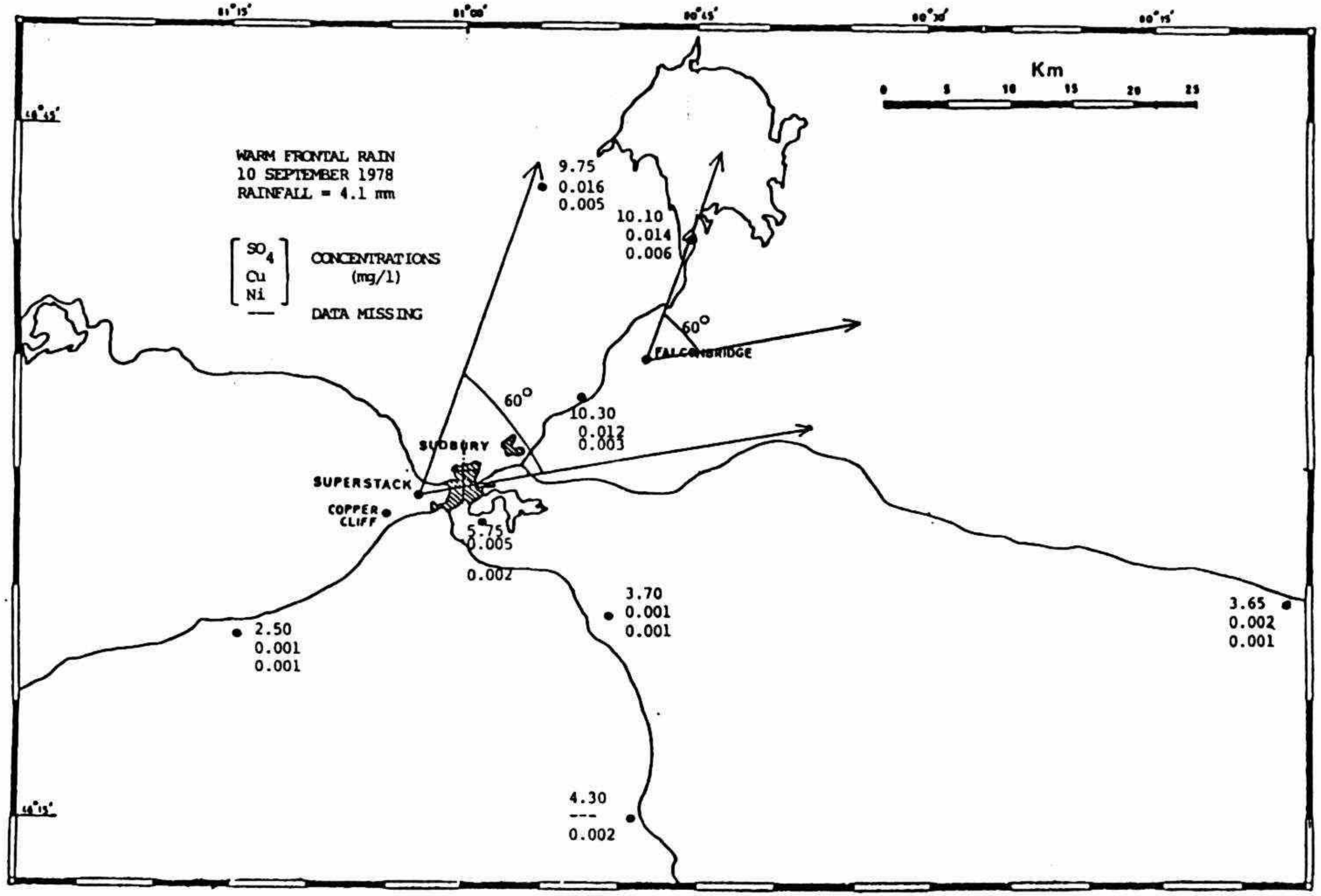


Figure 4: Plume Sector for Warm Frontal Rain Event of 10th September, 1978

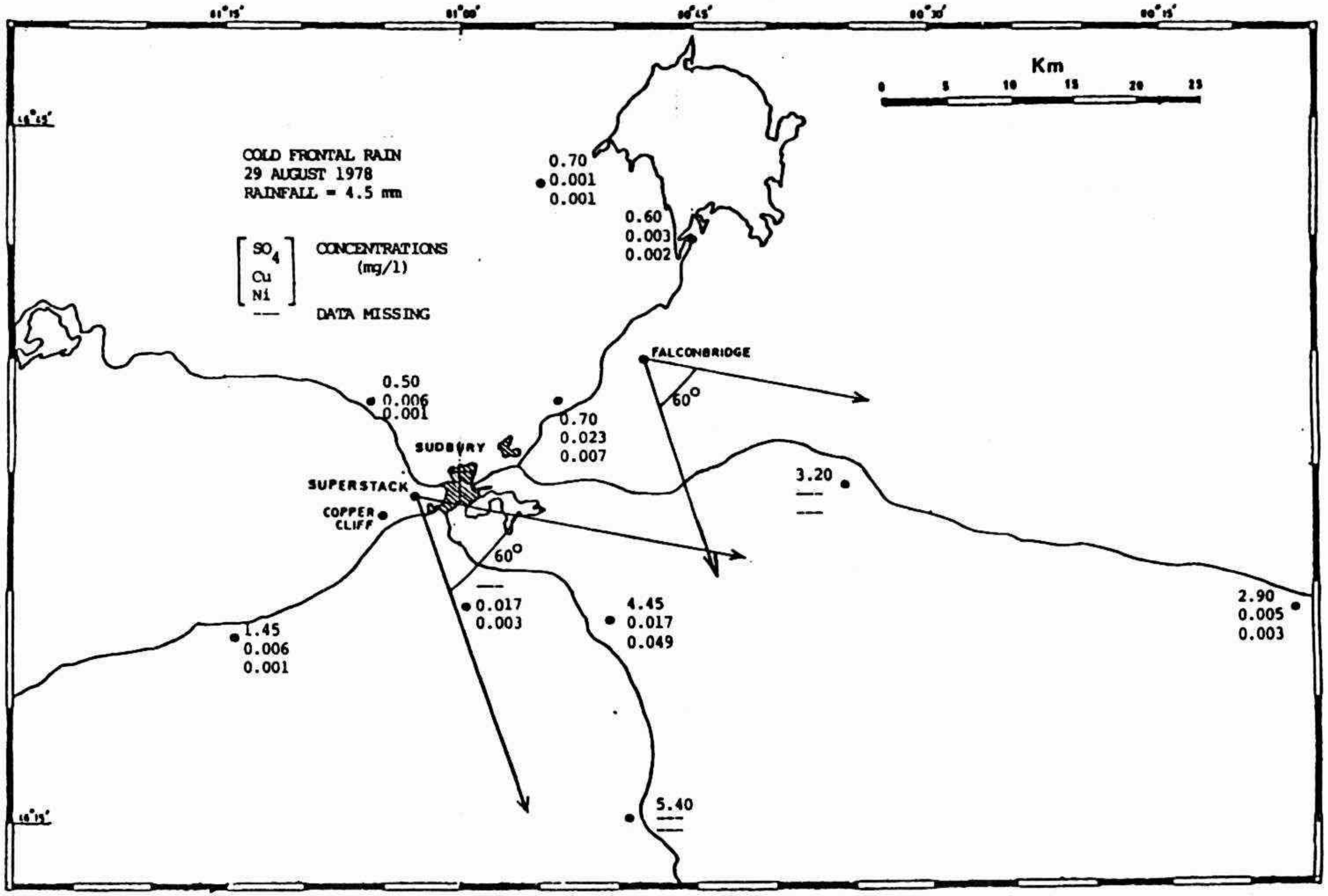


Figure 5: Plume Sector for Cold Frontal Rain Event of 29th August, 1978

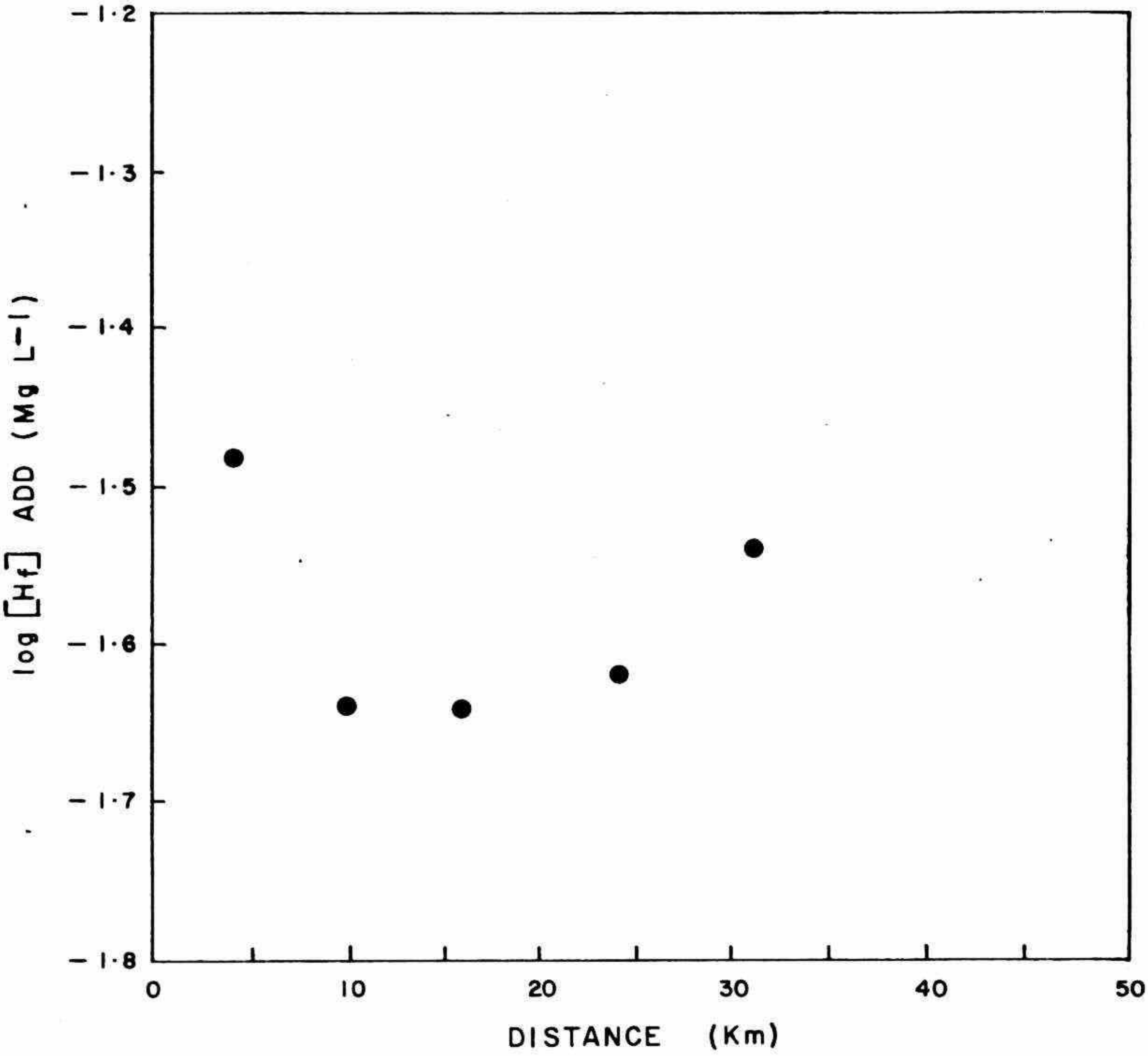


Figure 6: Dependence of Additional H_f Concentration on Distance from INCO Source

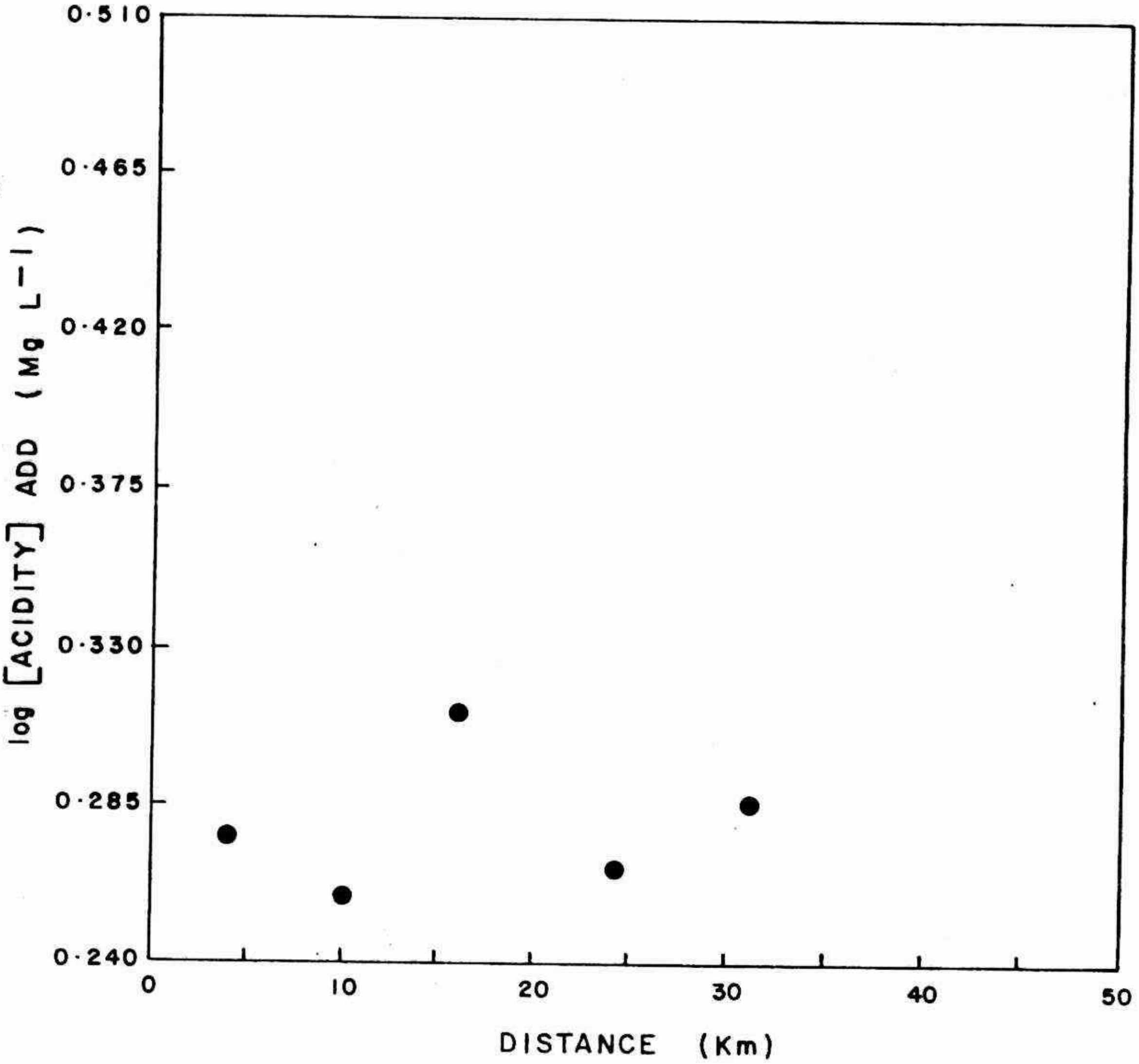


Figure 7: Dependence of Additional Acidity Concentration (expressed as mg $CaCO_3/1$) on Distance from INCO Source

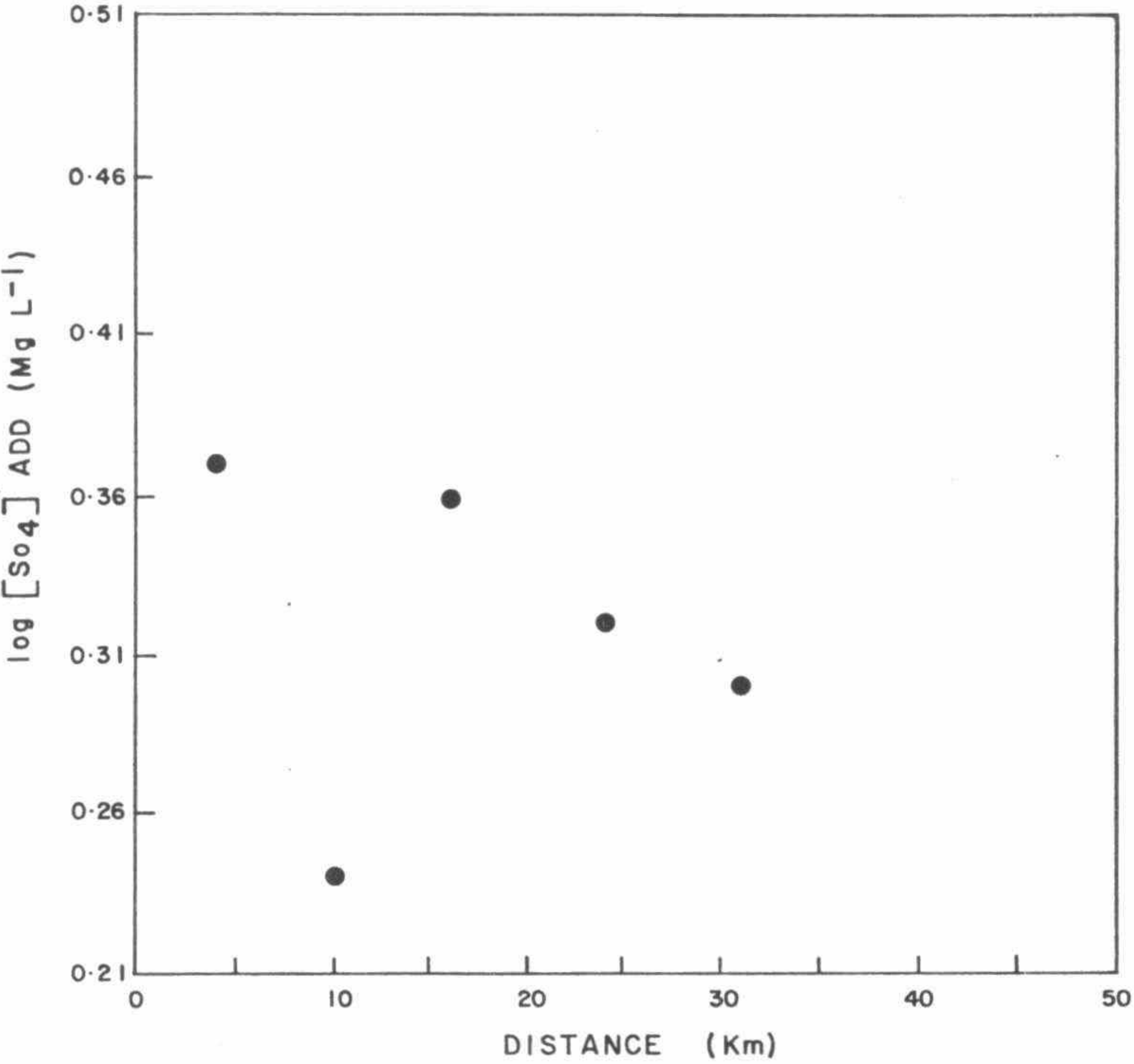


Figure 8: Dependence of Additional SO_4 Concentration on Distance from INCO Source

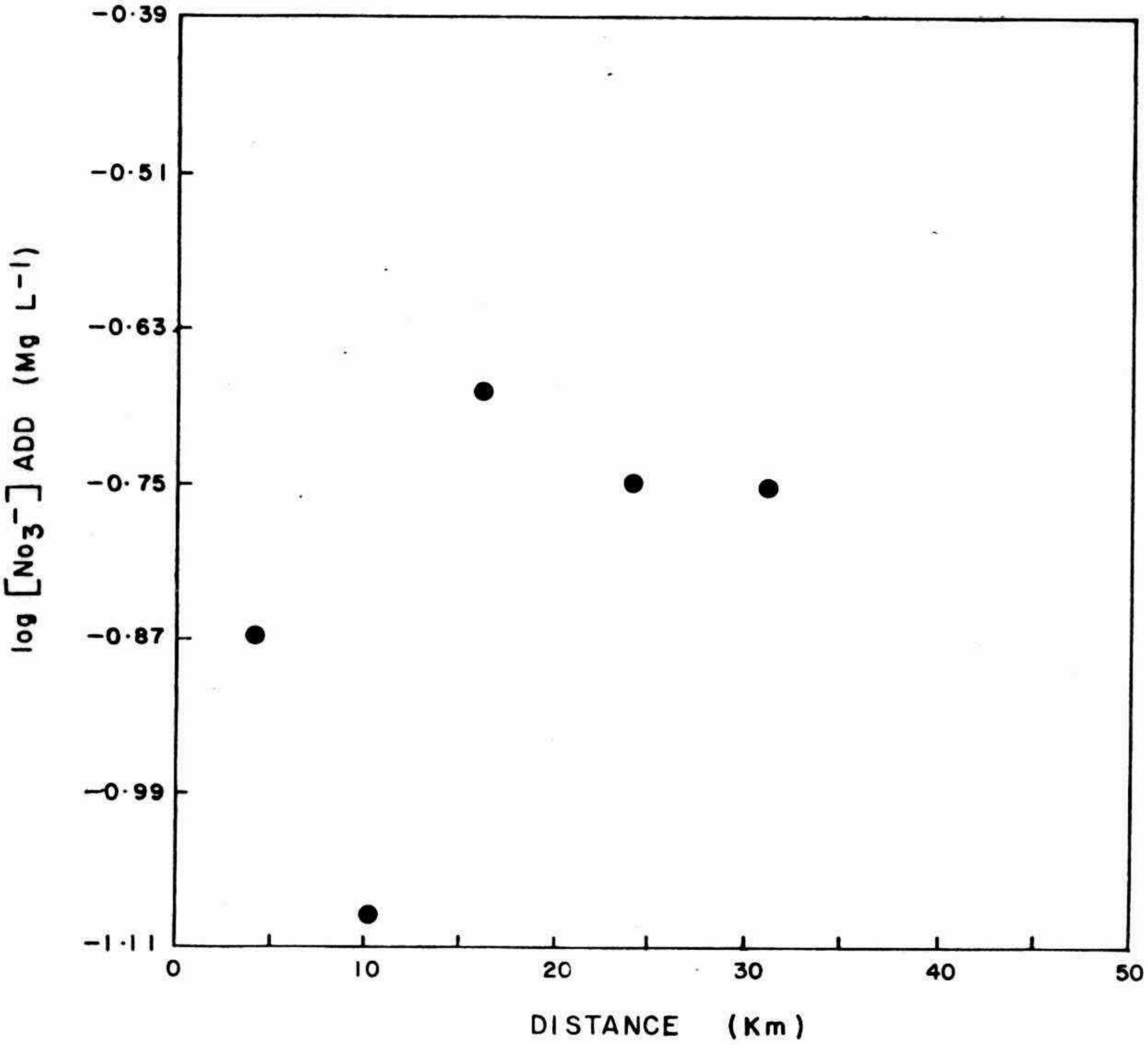


Figure 9: Dependence of Additional NO_3 Concentration on Distance from INCO Source

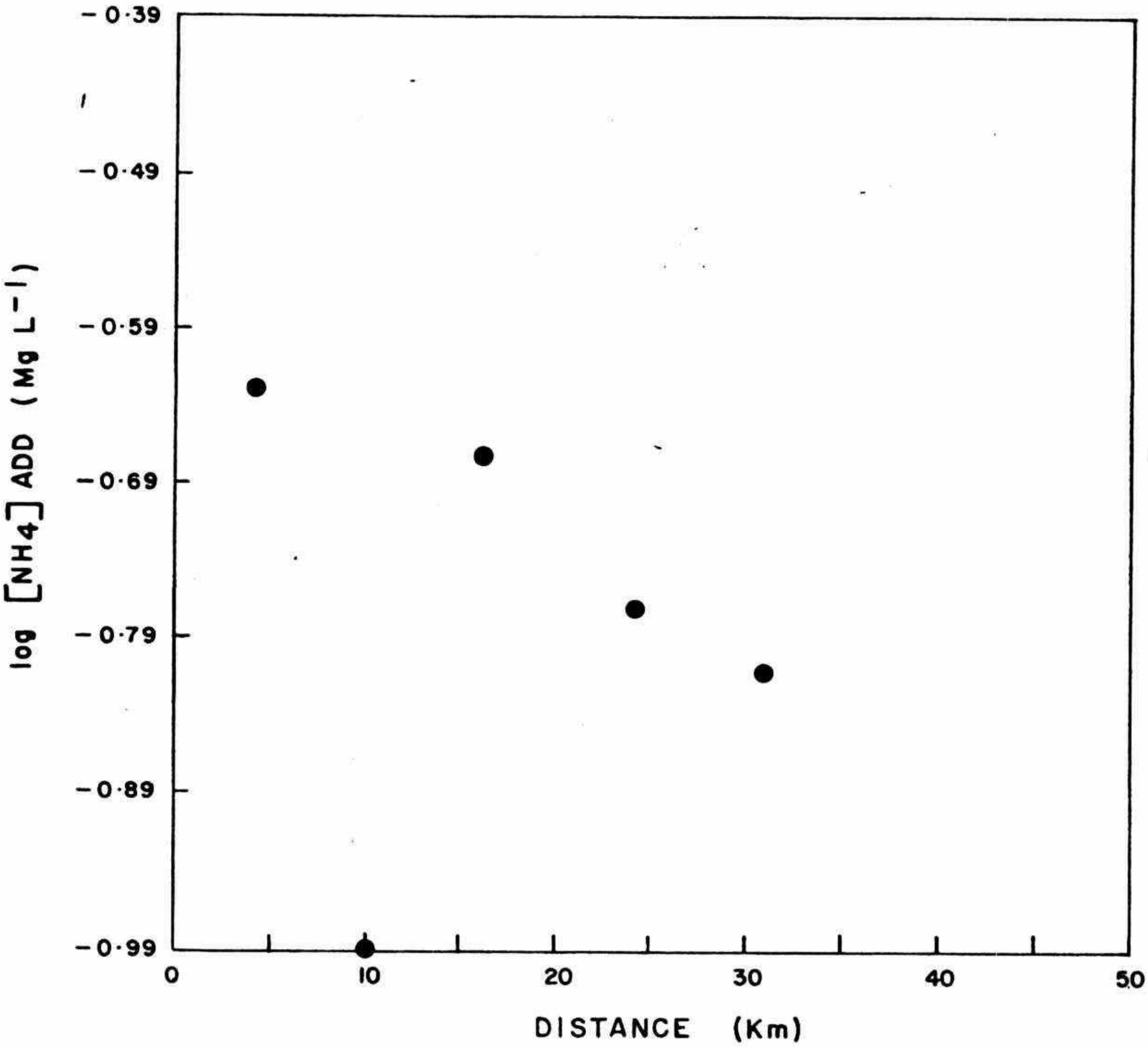


Figure 10: Dependence of Additional NH_4 Concentration on Distance from INCO Source

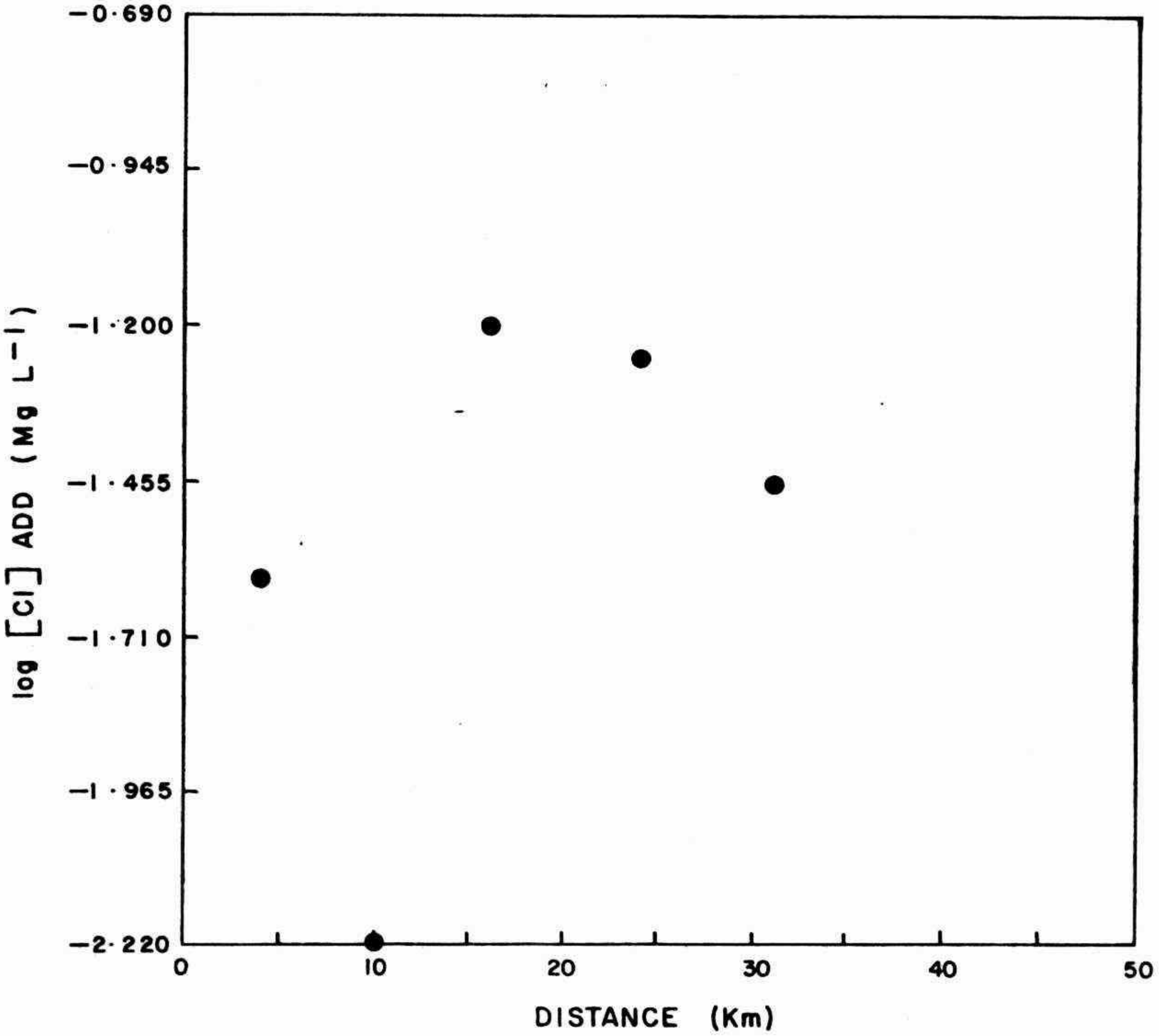


Figure 11: Dependence of Additional Cl Concentration on Distance from INCO Source

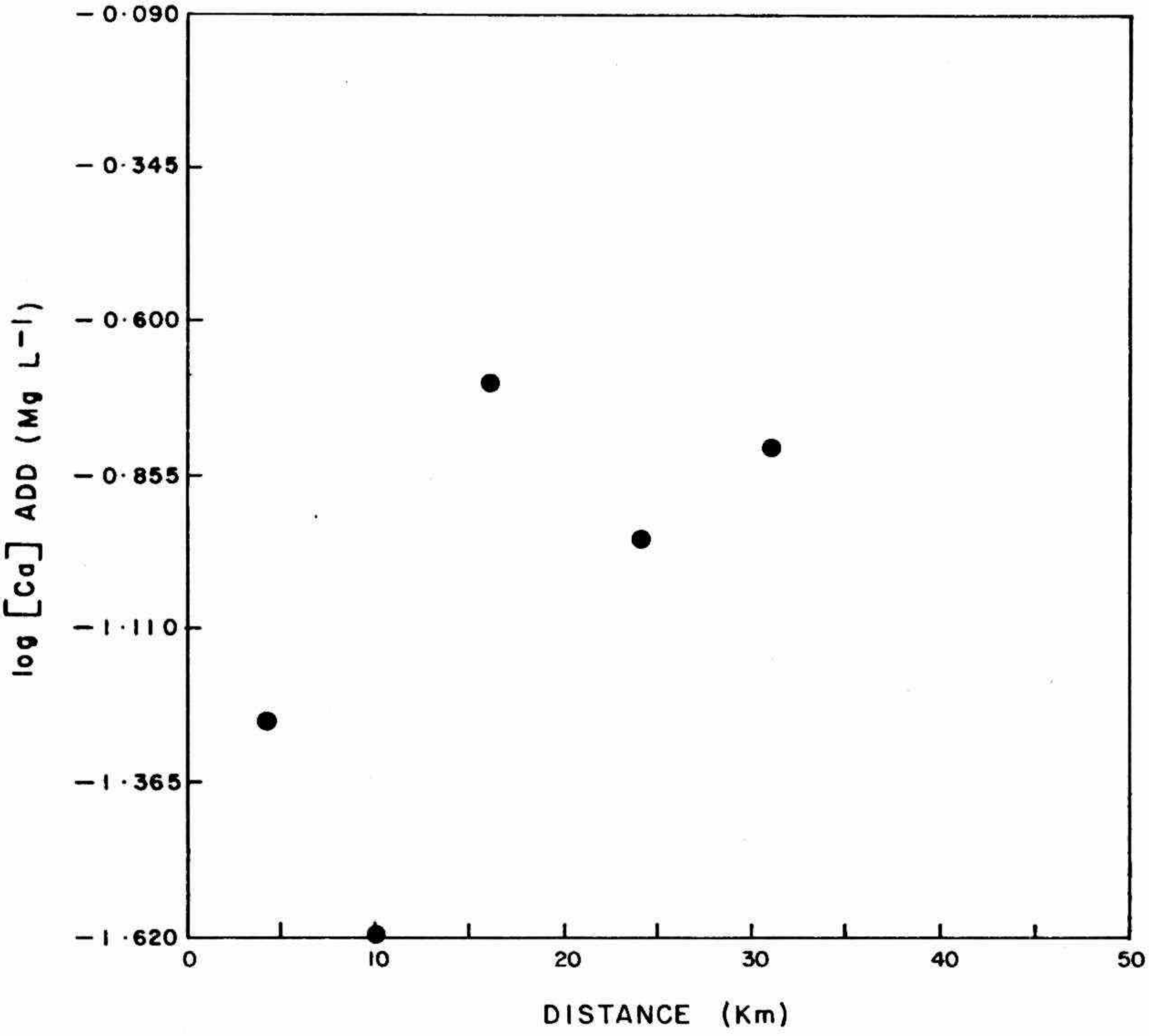


Figure 12: Dependence of Additional Ca Concentration on Distance from INCO Source

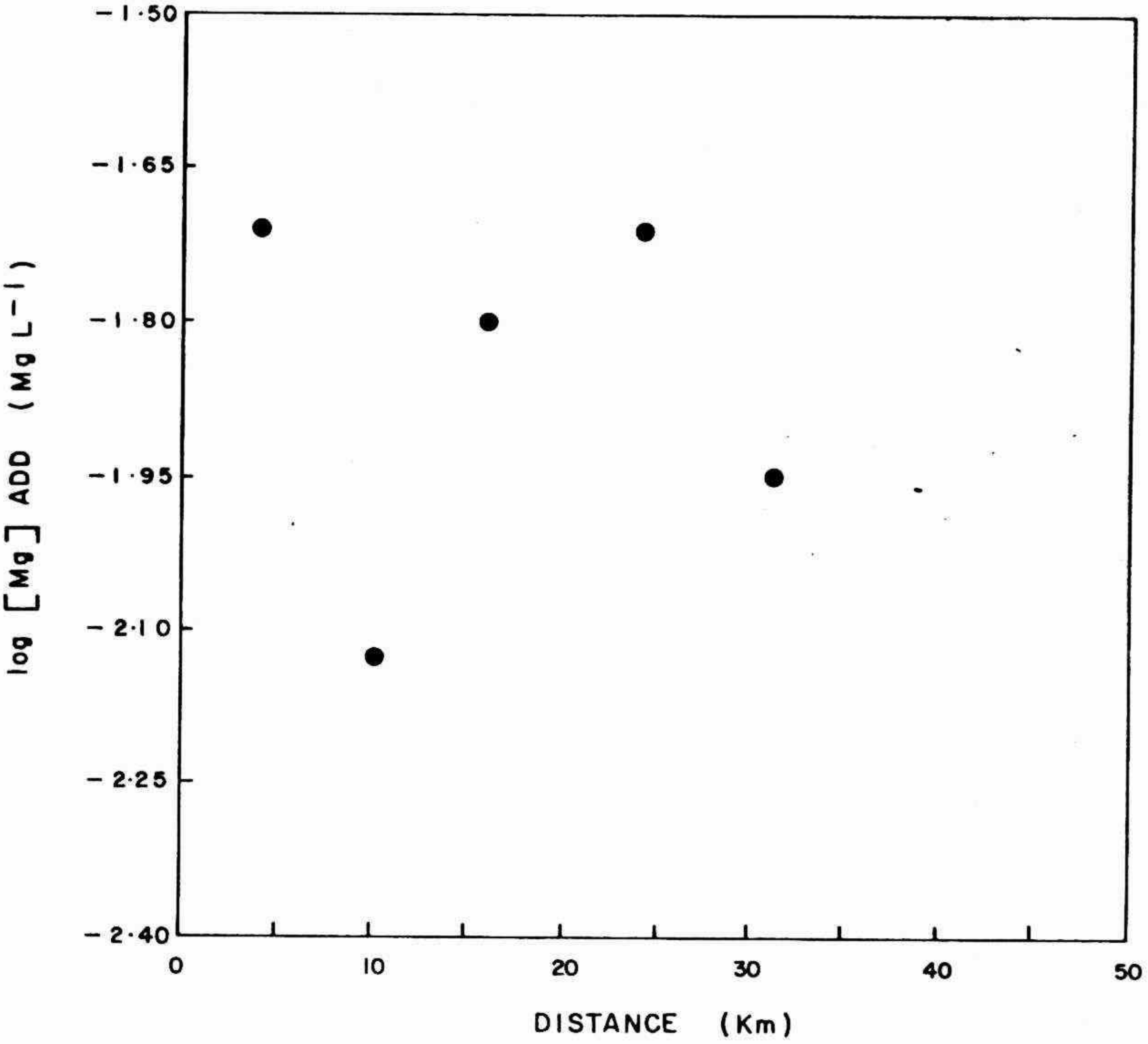


Figure 13: Dependence of Additional Mg Concentration on Distance from INCO Source

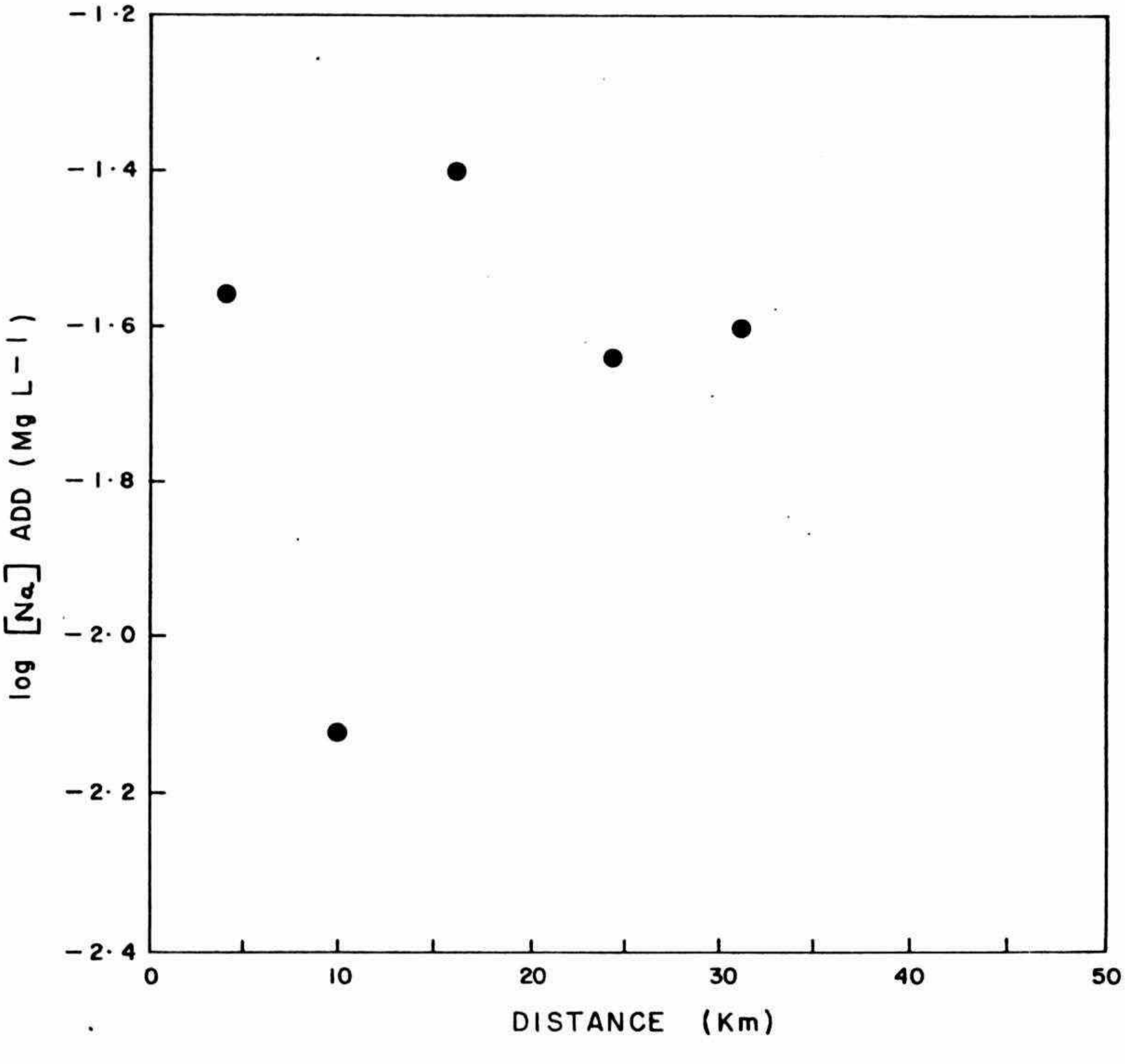


Figure 14: Dependence of Additional Na Concentration on Distance from INCO Source

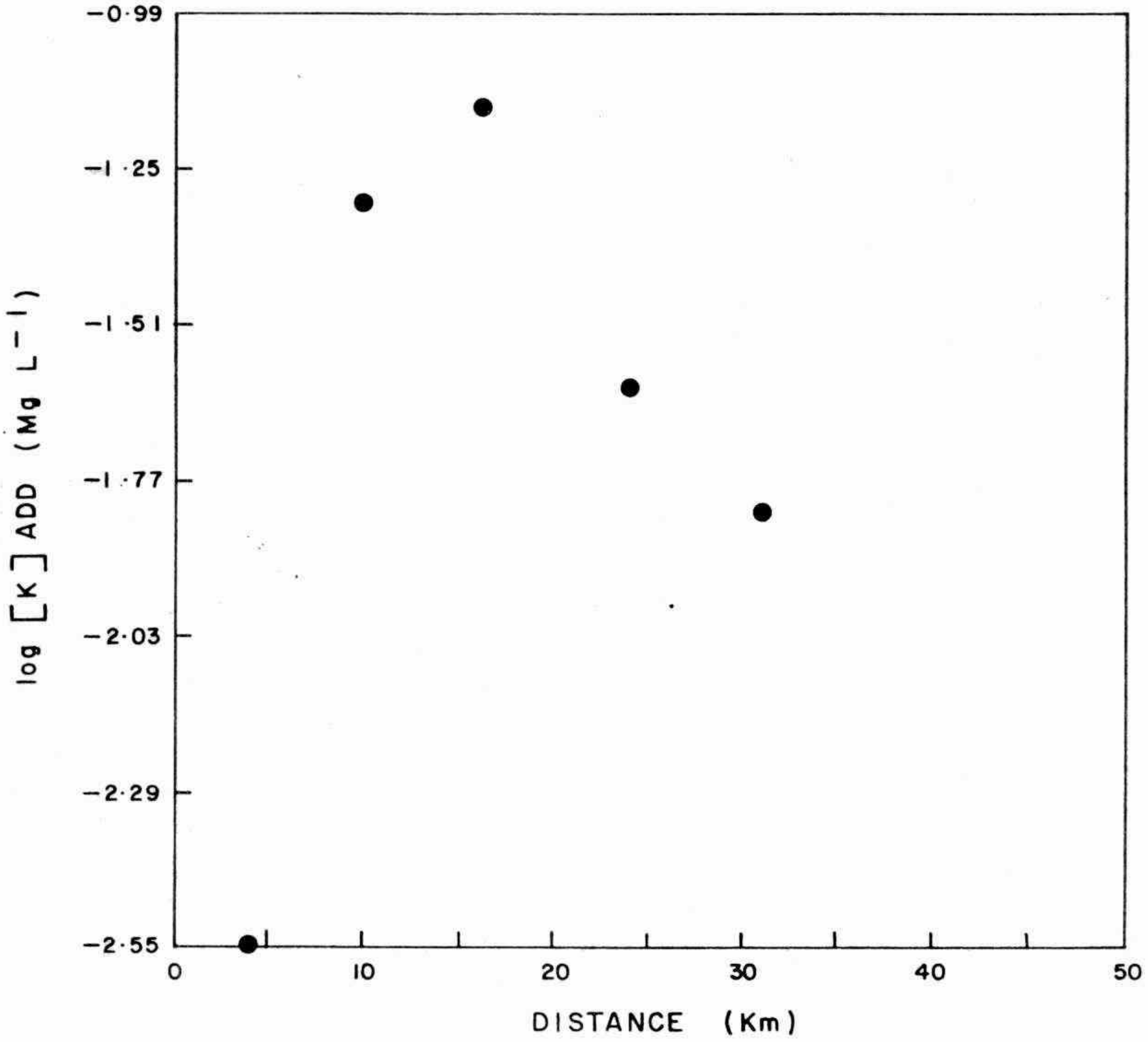


Figure 15: Dependence of Additional K Concentration on Distance from INCO Source

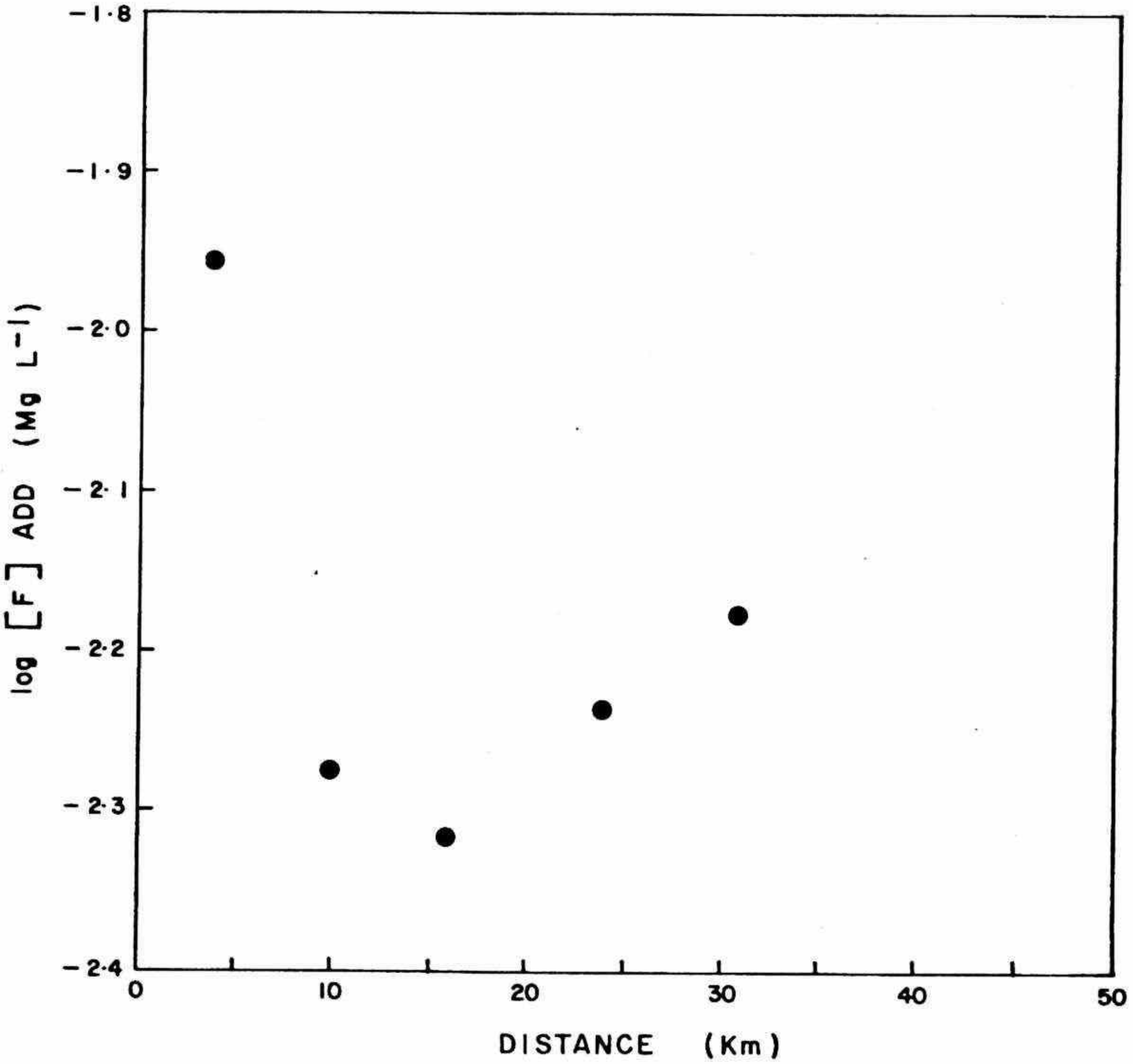


Figure 16: Dependence of Additional F Concentration on Distance from INCO Source

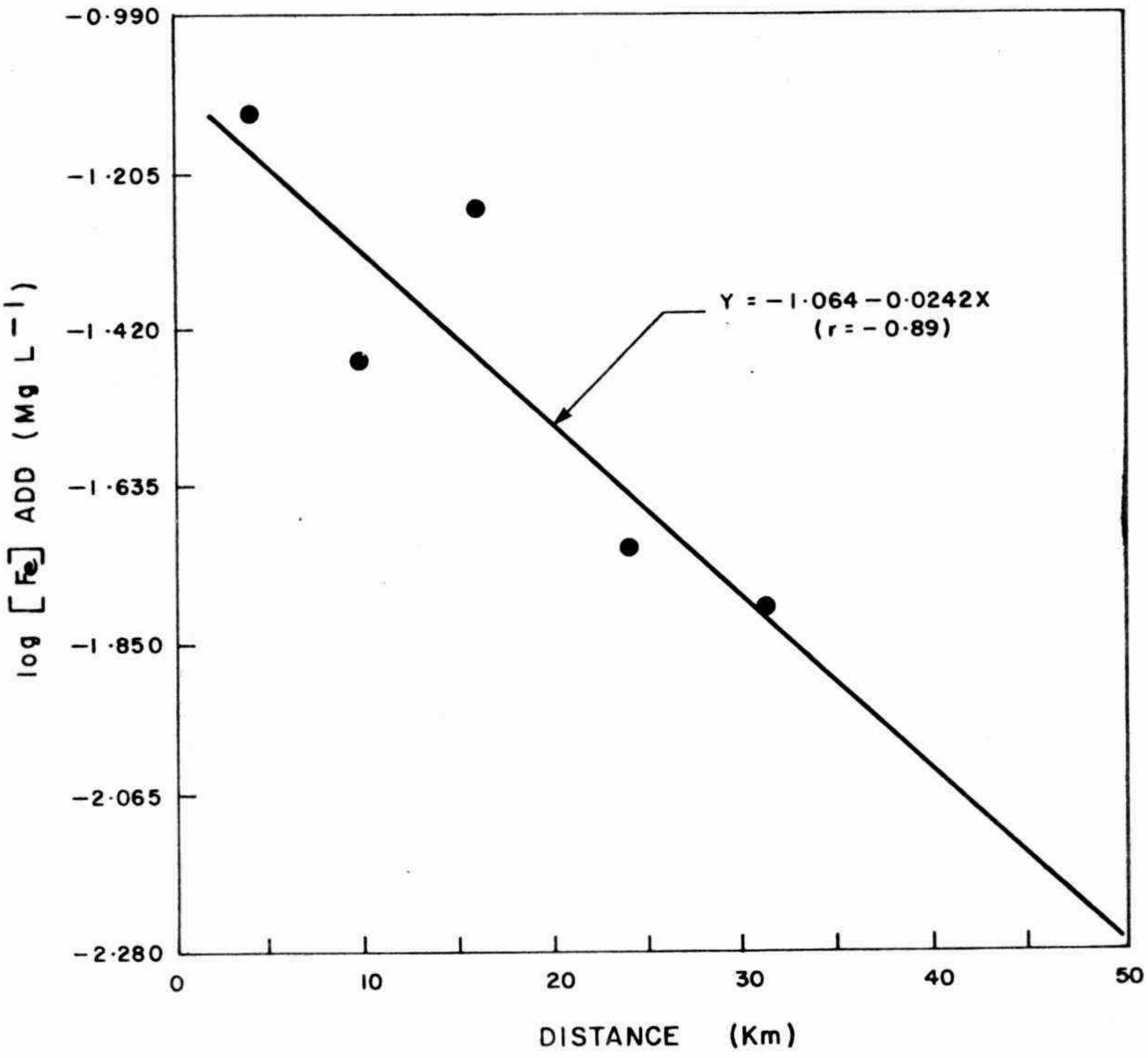


Figure 17: Dependence of Additional Fe Concentration on Distance from INCO Source

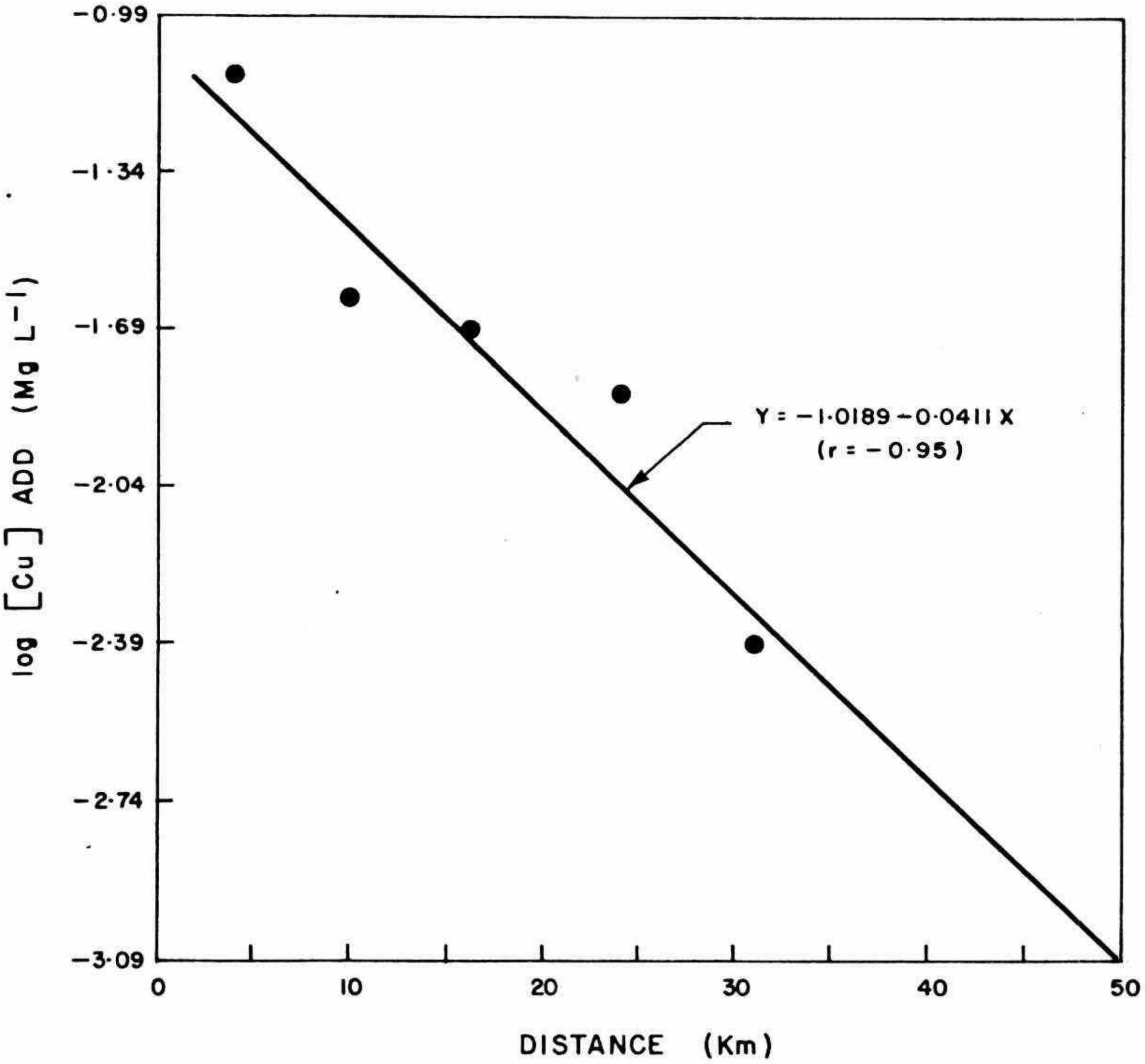


Figure 18: Dependence of Additional Cu Concentration on Distance from INCO Source

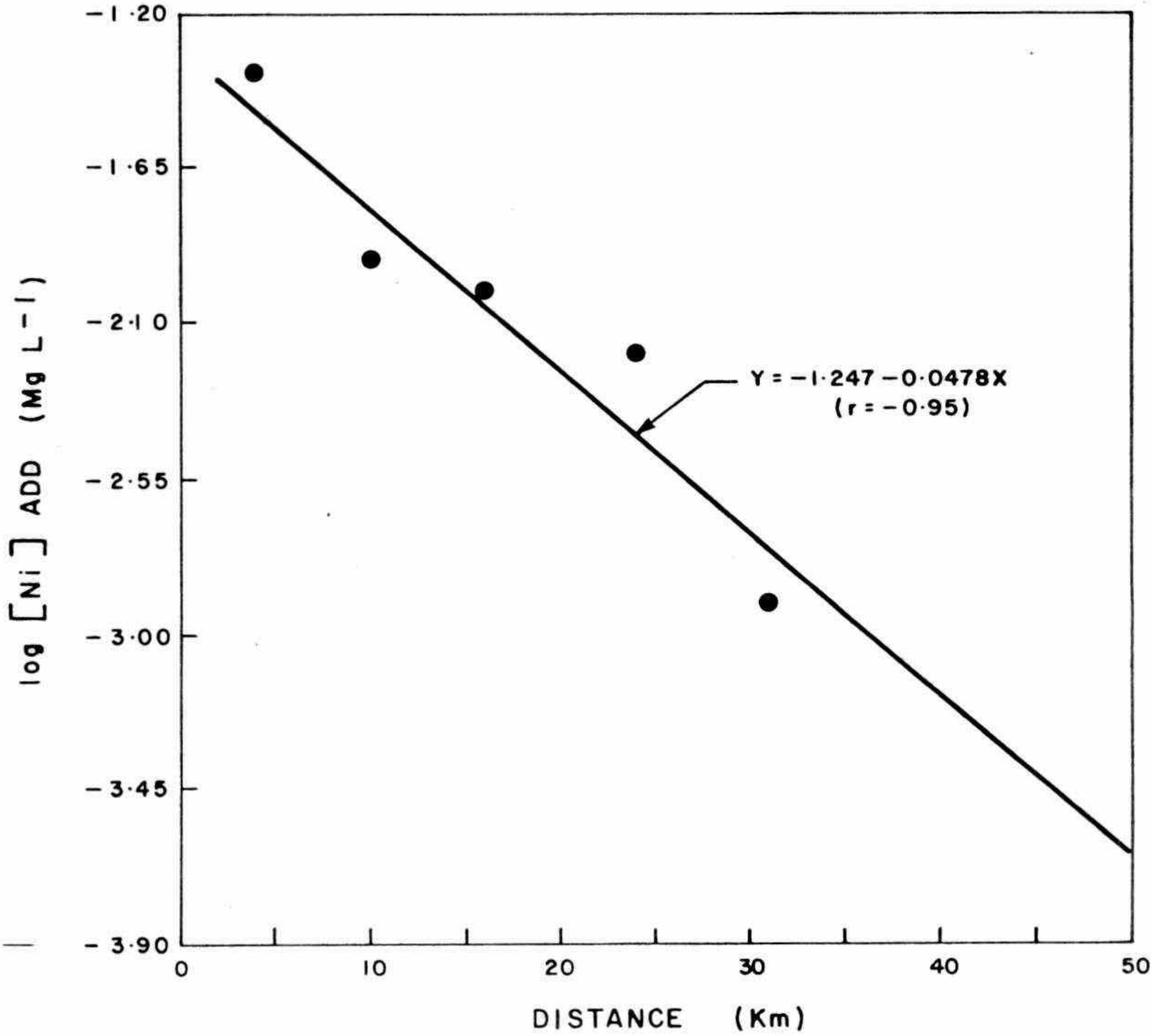


Figure 19: Dependence of Additional Ni Concentration on Distance from INCO Source

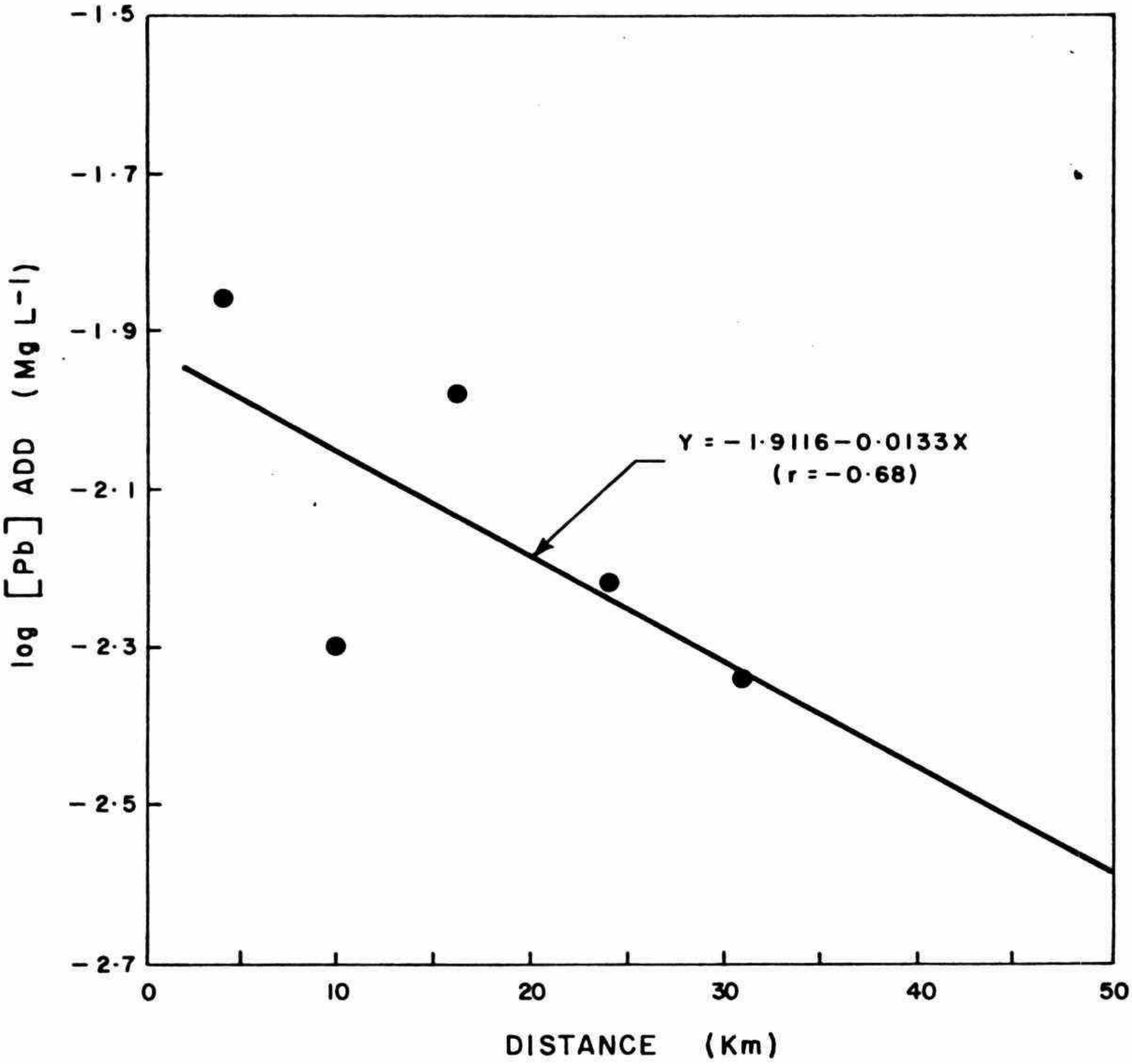


Figure 20: Dependence of Additional Pb Concentration on Distance from INCO Source

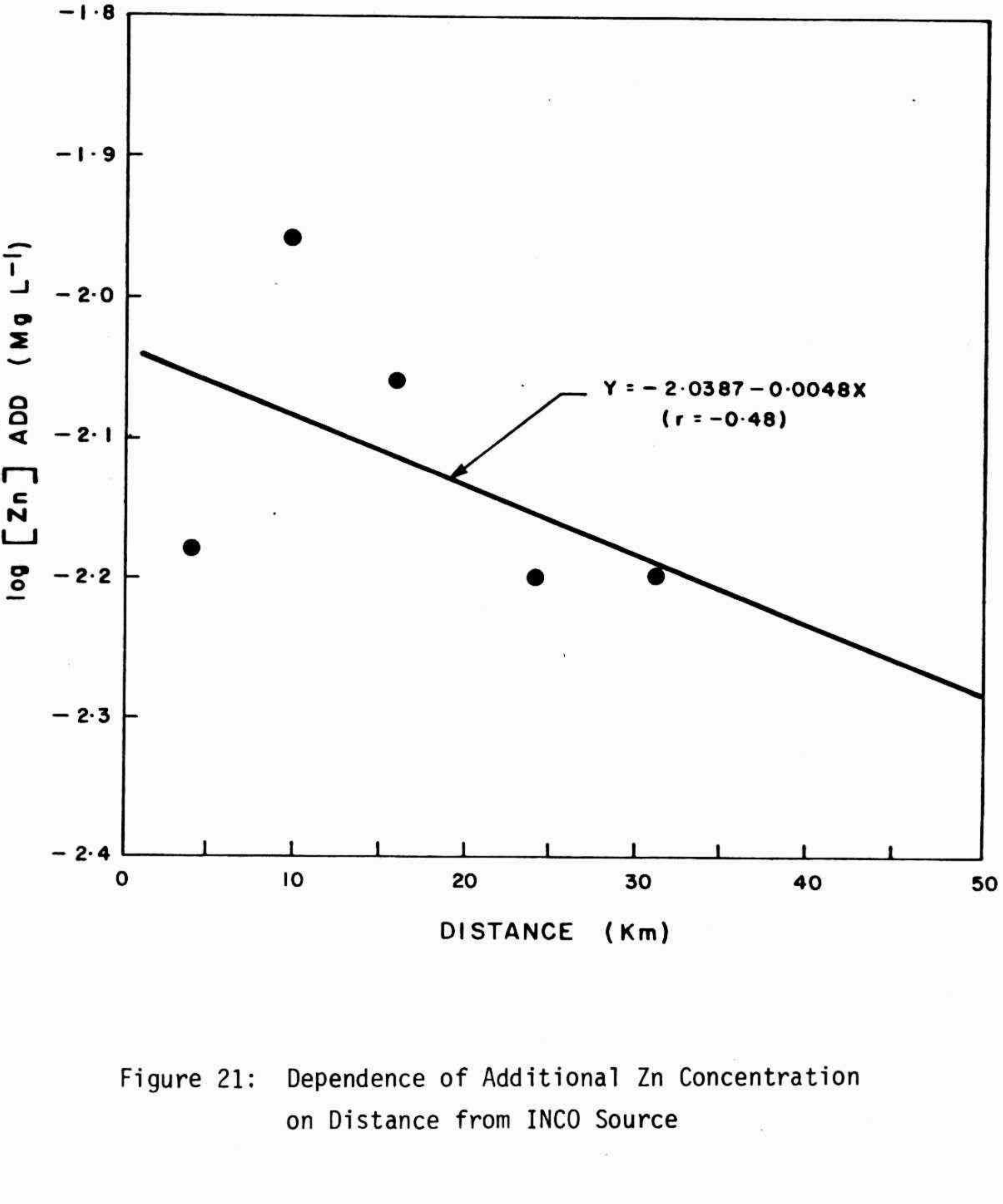


Figure 21: Dependence of Additional Zn Concentration on Distance from INCO Source

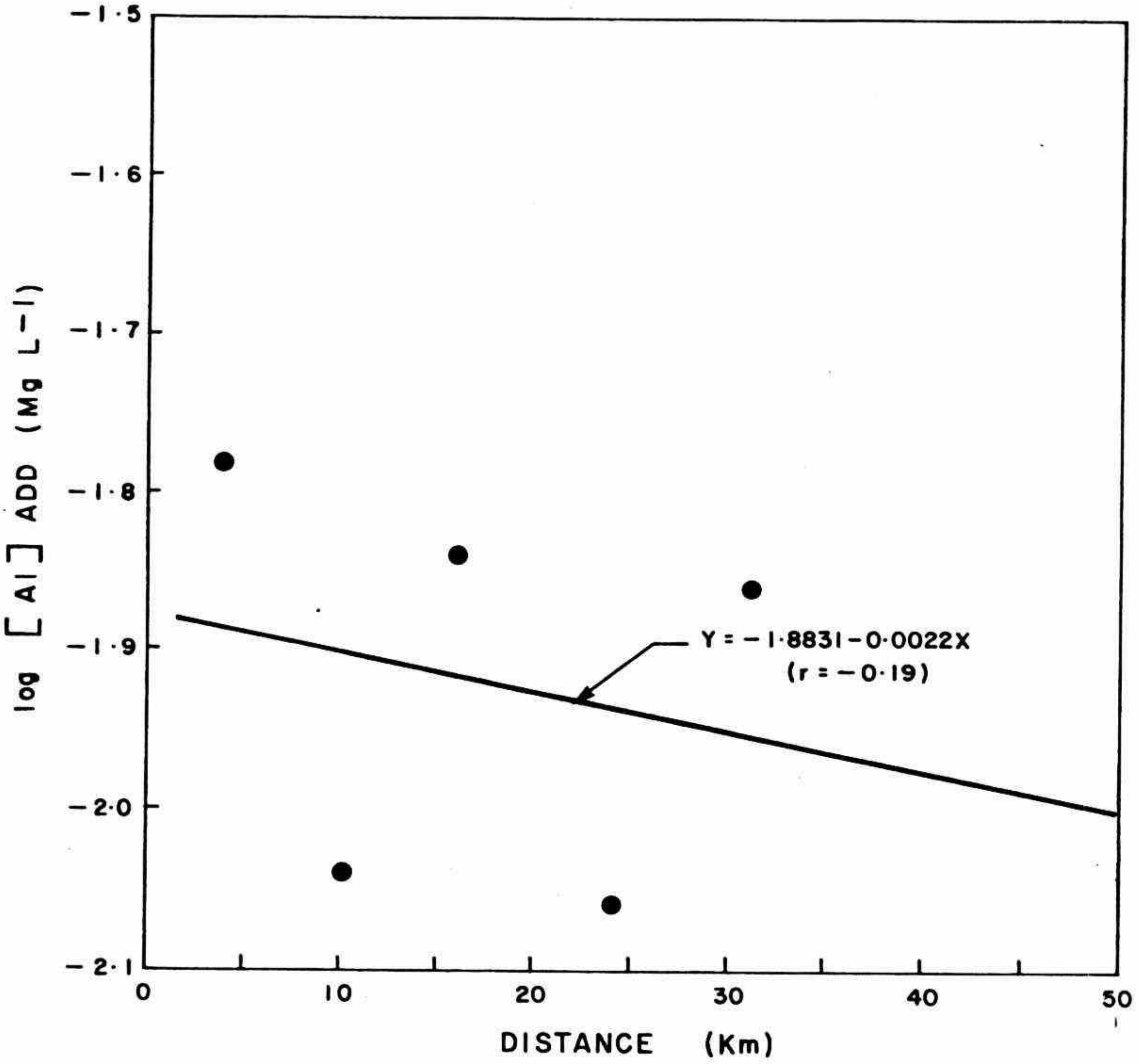


Figure 22: Dependence of Additional Al Concentration on Distance from INCO Source

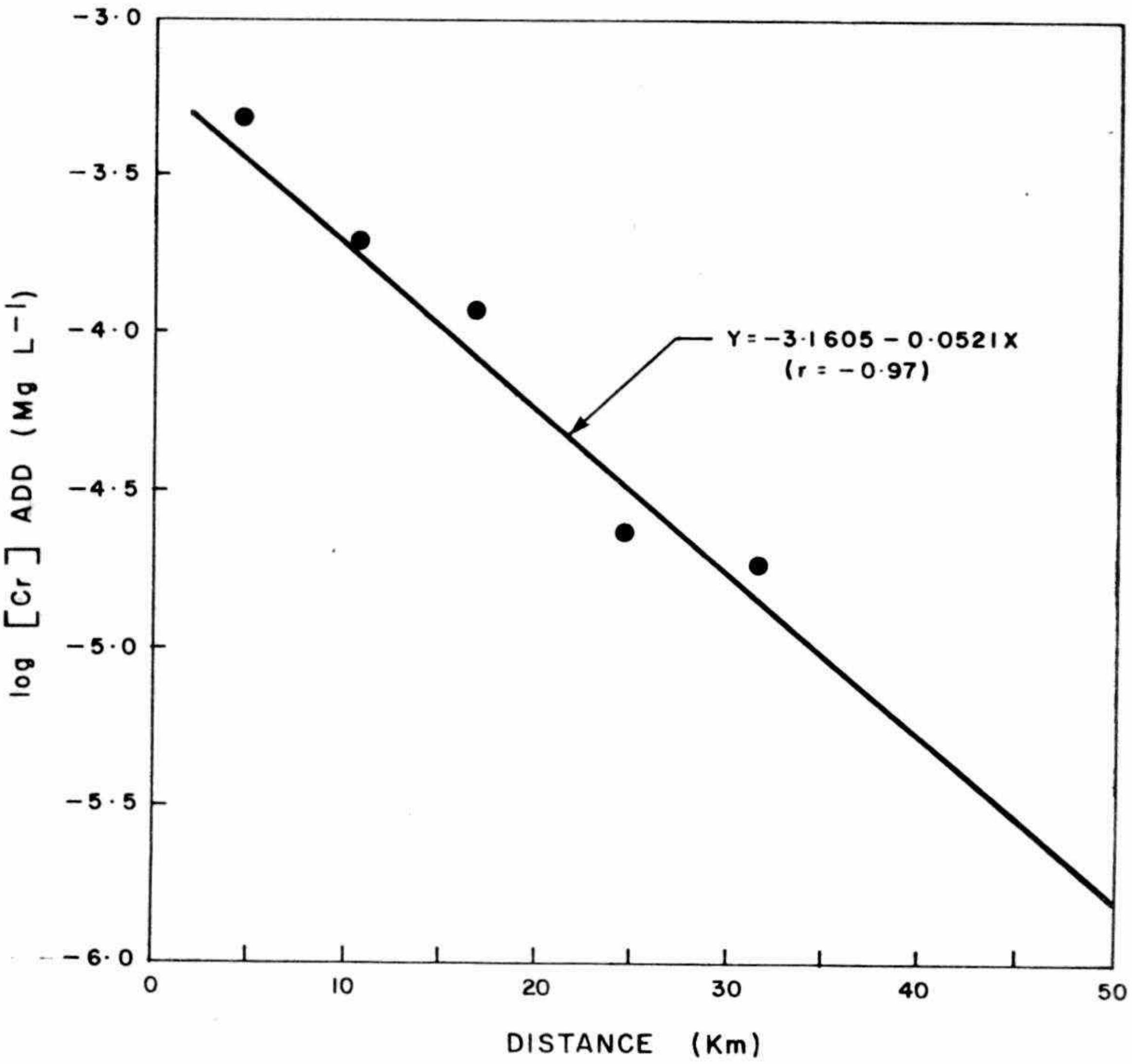


Figure 23: Dependence of Additional Cr Concentration on Distance from INCO Source

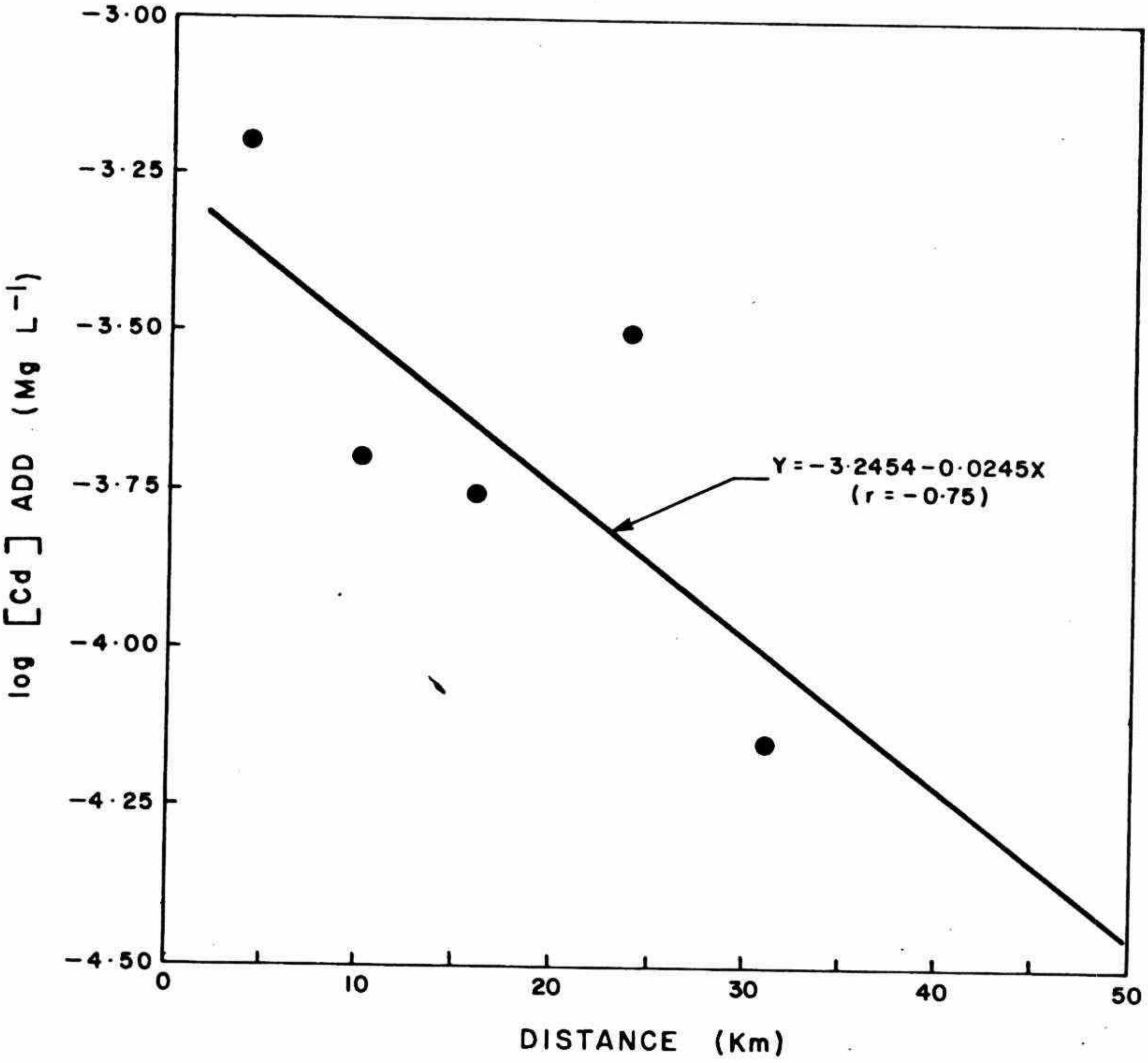


Figure 24: Dependence of Additional Cd Concentration on Distance from INCO Source

APPENDIX 1

Sampling Handling Criteria for Limited Volume Precipitation Samples

APPENDIX 1

Sample Handling Criteria for Limited Volume Precipitation Samples

Volume Collected (ml)	Handling Method
Less than 50	- pH measured at the field office - no sample submitted for chemical analysis
50 to 150	- no field pH measured - no metals analyses submitted -total volume submitted for laboratory analysis of major ions and pH
150 to 250	- no field pH measured - 25 ml placed in metals bottle - balance of volume submitted to laboratory for major ions, pH and acidity analysis.
250 to 500	- field pH measured - 25 ml transferred to metals bottle - balance submitted to laboratory for ion, pH acidity and conductivity analysis.
greater than 500	- field pH measured - metals bottle filled with 50 ml - balance submitted for ion, pH, acidity and conductivity analysis.

APPENDIX 2

Selected Precipitation Data Collected in Sudbury in 1978 and 1979

Data are presented according to sampling date and sampling station. Except for volume (ml) and pH, data are all expressed in concentration units (mg l^{-1}). Station numbers are labelled according to Figure 2. Samples from stations which are affected by INCO alone, Falconbridge alone, INCO and Falconbridge together, and INCO primarily plus small contributions from Falconbridge are designated as I, F, + and N respectively after the station number under the heading P. Those labelled with X are not included in calculations because of suspected contamination. Others which are not labelled correspond to background data. The symbols W and C in the first column correspond to the type of weather front that the precipitation event is associated with, i.e. warm or cold front. All concentration data which are missing because of insufficient volume or for other reasons are replaced by a "-9.00". Any value preceeded with a negative sign was not used in the calculations due to probable contamination. It should be noted that concentration of NO_3 and NH_4 are expressed as N-NO_3 and N-NH_4 in these Tables.

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INCO & FALRG OPERATING PERIOD SELECTED EVENTS
F ST P   VOL    HF     PH    ACID  SO4    NO3   NH4    CL   CA   MG   NA   K    F       FE    CU    NI    PB    ZN    AL    CR     CD
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780827
W  2     810. 0.191  3.72  7.91  4.80   0.52 0.354  0.16 1.10 0.01 0.04 0.03-9.00  0.016 0.001 0.001 0.014 0.016 0.007 0.0005 0.0001
W  3    1455. 0.141  3.85  9.38  4.35   0.41 0.302  0.11 0.21 0.01 0.04 0.02-9.00  0.048 0.001 0.001 0.012 0.046 0.026 0.0005 0.0001
W  5    2933. 0.079  4.10  5.55  3.80   0.43 0.302  0.11 0.19 0.01 0.06 0.03-9.00  0.018 0.001 0.001 0.009 0.037 0.009 0.0005 0.0001
W  9    2215. 0.056  4.25  7.17  3.40   0.44 0.240  0.09 0.15 0.02 0.04 0.04-9.00  0.011 0.001 0.001 0.008 0.008 0.005 0.0005 0.0001
W 10    2150. 0.028  4.55  9.57  3.60   0.20 0.238  0.14 0.37 0.03 0.07 0.03-9.00  0.008 0.001 0.001 0.007 0.008 0.004 0.0003 0.0001
-------------------------------------------------------------------------------------------------------------------------------------------
780828
C  2 X   630. 0.123  3.91 13.60  5.00   0.69 0.950  0.26 0.19 0.04 0.13 0.12-9.00  0.029 0.013 0.005 0.018 0.148 0.011 0.0005 0.0012
C  3 I  1290. 0.045  4.35  1.60  1.50   0.12 0.146  0.04 0.19 0.01 0.03 0.02-9.00  0.041 0.025 0.007 0.009 0.015 0.019 0.0005 0.0001
C  4 I   150. 0.050  4.30 -9.00  3.45   0.22-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  5 I  1153. 0.045  4.35  4.32  1.80   0.16 0.258  0.06 0.08 0.01 0.03 0.03-9.00  0.011 0.005 0.002 0.005 0.015 0.002 0.0005 0.0001
C  6     430. 0.023  4.64  2.06  1.10   0.10 0.150  0.04 0.13 0.02 0.05 0.03 0.01  0.012 0.001 0.001 0.004 0.004 0.006 0.0005 0.0001
C  7    1290. 0.013  4.90  3.21  1.95   0.12 0.800  0.15 0.07 0.03 0.17 0.25 0.03  0.015 0.001 0.001 0.006 0.004 0.008 0.0005 0.0001
C  8 F 2260. 0.083  4.08  5.38  3.90   0.34 0.320  0.06 0.18 0.02 0.06 0.09 0.01  0.019 0.001 0.001 0.010 0.008 0.025 0.0005 0.0001
C 16 F 1290. 0.026  4.58  1.22  1.50   0.09 0.250  0.21 0.08 0.04 0.03 0.07-9.00  0.045 0.003 0.001 0.006 0.008 0.031 0.0005 0.0001
C 17     575. 0.095  4.02  3.76  3.00   0.24 0.470  0.11 0.85 0.05 0.08 0.06-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 19 I  1075. 0.056  4.25  1.09  2.25   0.16 0.202  0.07 0.19 0.03 0.03 0.02-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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780829
C  2 I   251. 0.056  4.25 -9.00  5.40   0.19-9.000  0.30-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  3     860. 0.028  4.55  1.36  0.70   0.06 0.076  0.08 0.21 0.01 0.04 0.04-9.00  0.017 0.023 0.007 0.005 0.004 0.003 0.0005 0.0001
C  4 I   375. 0.008  5.10 -9.00 -9.00 -9.00 0.324 -9.00 0.23 0.02-0.54 0.36-9.00  0.026 0.017 0.003 0.003 0.038 0.010 0.0005 0.0004
C  5 I   550. 0.081  4.09  5.27  4.45   0.06 0.224  0.08 0.38 0.08 0.08 0.06 0.02  0.080 0.067 0.049 0.012 0.005 0.021 0.0005 0.0007
C  7     325. 0.012  4.92  2.06  0.50   0.09 0.098  0.44 0.18 0.04 0.08 0.03 0.03  0.162 0.006 0.001 0.004 0.009 0.037 0.0005 0.0001
C  8    1355. 0.009  5.03  1.95  0.60   0.04 0.076  0.05 0.28 0.05 0.06 0.05 0.01  0.053 0.003 0.002 0.003 0.008 0.029 0.0040 0.0001
C  9    1625. 0.032  4.49  5.04  1.45   0.13 0.170  0.05 0.26 0.04 0.07 0.04 0.02  0.006 0.006 0.001 0.002 0.003 0.004 0.0005 0.0001
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P   VOL    HF     PH    ACID  SO4   NO3   NH4    CL   CA   MG   NA   K    F      FE    CU    NI    PB    ZN    AL     CR     CD
C 16 F   210. 0.078  4.11 -9.00  3.20  0.18-0.208  0.18 0.21 0.04 0.07 0.23-0.19 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 19 X   220. 0.083  4.08 -9.00  6.20  0.12-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  1.200 1.090 0.570 0.080 0.051 0.034 0.0010 0.0124
C 21    1280. 0.028  4.55  1.20  0.70  0.07 0.090  0.17 0.10 0.01 0.11 0.13-9.00  0.023 0.001 0.001 0.002 0.008 0.010 0.0005 0.0001
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780902
W  2     860. 0.050  4.30  2.29  3.90  0.43 0.440  0.07 0.52 0.06 0.08 0.08 0.01  0.021 0.002 0.001 0.009 0.013 0.010 0.0005 0.0001
W  5    6204. 0.076  4.12  4.58  3.25  0.25 0.346  0.05 0.39 0.05 0.07 0.06 0.09  0.023 0.006 0.002 0.007 0.008 0.009 0.0005 0.0001
W  6     430. 0.076  4.12  4.69  4.00  0.41 0.480  0.07 0.34 0.05 0.07 0.06 0.01  0.054 0.001 0.001 0.013 0.008 0.044 0.0005 0.0001
W  8 I  4545. 0.068  4.17  4.24  3.85  0.30 0.390  0.05 0.58 0.09 0.11 0.08 0.01  0.087 0.009 0.003 0.012 0.017 0.080-0.0070 0.0001
W 16 *  1290. 0.095  4.02  6.76  7.30  0.60 1.200  0.17 0.67 0.09 0.09 0.14 0.01  0.040 0.006 0.002 0.017 0.010 0.031 0.0005 0.0001
W 21    3335. 0.054  4.27  4.35  2.60  0.30 0.354  0.04 0.47 0.06 0.04 0.04 0.01  0.031 0.002 0.001 0.008 0.002 0.019 0.0005 0.0001
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780906
W  2    2850. 0.074  4.13  6.07  2.50  0.34 0.710  0.10 0.38 0.05 0.05 0.06 0.02  0.081 0.008 0.002 0.007 0.015 0.049 0.0010 0.0003
W  5 *   420. 0.089  4.05  7.21 10.00  0.85 1.980  0.25 1.05 0.18-0.28 0.21 0.02  0.151 0.014 0.005 0.013 0.012 0.097 0.0005 0.0002
W  6 I   430. 0.062  4.21  4.58  5.00  0.39 0.740  0.07 0.39 0.07 0.07 0.06 0.03  0.106 0.044 0.025 0.016 0.007 0.072 0.0005 0.0006
W  7     550. 0.014  4.85  3.78  3.20  0.55 0.900  0.11 0.72 0.12 0.13 0.07 0.03  0.092 0.003 0.001 0.014 0.007 0.081 0.0005 0.0001
W  9 X   200. 0.132  3.88  9.05  8.31  0.22 0.400 -9.00-9.00-9.00 0.11 0.10 0.06  0.159 0.330 0.134 0.037 0.020 0.030 0.0005 0.0039
W 17 I  1505. 0.050  4.30  4.35  4.50  0.68 1.020  0.32 0.99 0.15 0.16 0.18 0.07  0.[illegible]26 0.0[illegible] [illegible]011 0.011 0.071 0.080 0.0005 0.0005
W 19 I   645. 0.085  4.07  6.29  6.85  0.53 0.970  0.15 0.65 0.12 0.10 0.09 0.04  0.118 0.039 0.015 0.015 0.032 0.072 0.0005 0.0003
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780909
W  2 X    40. 0.141  3.85 -9.00 11.10  1.18-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W  5     580. 0.052  4.28  6.29  6.35  0.58 1.340  0.19 0.73 0.10 0.11 0.12 0.06  0.107 0.003 0.001 0.017 0.012 0.098 0.0005 0.0001
W  7 I   820. 0.123  3.91  7.98  9.10  0.62 1.190  0.15 0.80 0.11 0.12 0.08 0.01  0.119 0.010 0.004 0.022 0.017 0.069 0.0005 0.0001
W  9     825. 0.078  4.11  5.73  5.30  0.77 1.020  0.10 0.63 0.12 0.07 0.10 0.03  0.018 0.001 0.001 0.010 0.030 0.014 0.0005 0.0001
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780910
W  2     855. 0.083  4.08  5.95  4.30  0.51 0.510  0.07 0.63 0.08 0.08 0.06 0.01  0.129 0.018 0.002 0.013 0.015 0.078 0.0005 0.0001
W  3 I   440. 0.191  3.72 14.89 10.30  1.06 1.210  0.27 1.16 0.17 0.16 0.10 0.07  0.290 0.012 0.003 0.025 0.009 0.147 0.0005 0.0001
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P   VOL    HF     PH   ACID   SO4   NO3   NH4    CL   CA   MG   NA    K    F      FE    CU    NI    PB    ZN    AL     CR     CD
W  5    1040. 0.047  4.33  4.81   3.70  0.54 0.790  0.11 0.50 0.11 0.19 0.05 0.06  0.070 0.001 0.001 0.012 0.007 0.073 0.0005 0.0001
W  8 I   475. 0.138  3.86  6.59  10.10  1.00 1.630  0.20-9.00-9.00-9.00-9.00 0.03  0.118 0.014 0.006 0.023 0.029 0.123-0.0065 0.0003
W  9     350. 0.025  4.61  2.75   2.50  0.39 0.430  0.06 0.53 0.02 0.05 0.07 0.02  0.008 0.001 0.001 0.008 0.067 0.004 0.0005 0.0001
W 17 X   175. 0.126  3.90 -9.00   8.55  1.10 1.430 -9.00 0.94-9.00 0.22 0.37-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 19     700. 0.095  4.02  7.10   5.75  0.81 1.090  0.19 0.51 0.09 0.14 0.09 0.02  0.078 0.005 0.002 0.013 0.018 0.061 0.0005 0.0002
W 21 I   740. 0.182  3.74 11.56   9.75  1.20 1.670  0.22 1.36 0.16 0.14 0.14 0.03  0.180 0.016 0.005 0.032 0.027 0.079 0.0005 0.0010
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780911
C  2 I   370. 0.102  3.99  4.92   4.30  0.52 0.580  0.34 0.40 0.05 0.27 0.08 0.02  0.023 0.017 0.002 0.013 0.026 0.009 0.0005 0.0001
C  5 I   415. 0.076  4.12  5.50   3.60  0.62 0.780  0.12 0.13 0.02 0.08 0.05 0.04  0.052 0.012 0.007 0.016 0.012 0.023 0.0005 0.0001
C  8 X   125. 0.069  4.16 -9.00   3.95  0.37 0.410 -9.00 0.80 0.11 0.07 0.31-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 19 I   350. 0.117  3.93 10.30   4.10  0.50 0.840  0.11 0.17 0.04 0.10 0.11 0.02 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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780914
W  2    3795. 0.100  4.00  6.76   3.35  0.34 0.182  0.11 0.12 0.01 0.06 0.04 0.01  0.007 0.001 0.001 0.011 0.009 0.006 0.0005 0.0001
W  3    1940. 0.105  3.98  7.21   4.20  0.48 0.302  0.13 0.12 0.02 0.05 0.03 0.03  0.018 0.003 0.001 0.010 0.010 0.009 0.0005 0.0001
W  5    2210. 0.115  3.94  6.87   4.25  0.40 0.276  0.15 0.14 0.01 0.08 0.03 0.03  0.011 0.001 0.001 0.010 0.008 0.008 0.0005 0.0001
W  8    2430. 0.132  3.88  6.53   4.10  0.36 0.190  0.08 0.19 0.04 0.08 0.01 0.02  0.011 0.001 0.001 0.007 0.012 0.014 0.0005 0.0001
W  9    2490. 0.126  3.90  7.21   4.50  0.53 0.334  0.08 0.25 0.07 0.09 0.04 0.03  0.010 0.001 0.001 0.014 0.011 0.005 0.0005 0.0001
W 16    1150. 0.093  4.03  7.44   4.95  0.47 0.480  0.07 0.44 0.04 0.06 0.06 0.02  0.012 0.001 0.001 0.009 0.008 0.010 0.0005 0.0001
W 19    1915. 0.065  4.19  5.27   4.50  0.27 0.004  0.21 0.09 0.02 0.33 0.08 0.02  0.072 0.010 0.004 0.020 0.048 0.038 0.0005 0.0002
W 21 F  2045. 0.126  3.90  8.02   5.35  0.46 0.272  0.08 0.14 0.02 0.08 0.06 0.02  0.015 0.003 0.001 0.012 0.010 0.010 0.0005 0.0001
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780915
C  2 X    50. 0.042  4.38 -9.00   2.51  0.48-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  5     185. 0.021  4.67 -9.00   1.35  0.28 0.550 -9.00 0.13 0.04 0.16 0.09-9.00  0.037 0.011 0.002 0.008 0.015 0.033 0.0005 0.0001
C  9     175. 0.020  4.70 -9.00   0.60  0.20 0.300 -9.00 0.51 0.06 0.08 0.08-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 16 F  2695. 0.079  4.10  3.92   2.55  0.24 0.142  0.05 0.10 0.03 0.03 0.01 0.02  0.008 0.001 0.001 0.008 0.013 0.006 0.0005 0.0006
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P   VOL   HF     PH    ACID  SO4    NO3   NH4     CL   CA   MG   NA   K    F       FE    CU    NI    PB    ZN    AL    CR     CD
C 19 I   315. 0.056  4.25 -9.00  3.00  0.34 0.360 -9.00 0.45 0.13 0.42 0.12-9.00  0.057 0.022 0.020 0.011 0.008 0.020 0.0005 0.0001
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790609

W  2     674. 0.135  3.87 10.52  7.70  1.31 0.970  0.26 0.35 0.06 0.06 0.08 0.04  0.020 0.002 0.001 0.013 0.018 0.014 0.0005 0.0004
W  5    1777. 0.071  4.15  8.32  6.75  0.72 0.895  0.19 0.21 0.05 0.08 0.08 0.04  0.036 0.002 0.001 0.012 0.010 0.022 0.0005 0.0004
W  7 I  1166. 0.068  4.17  8.70  7.25  0.68 0.710  0.20 0.13 0.04 0.06 0.07 0.04  0.046 0.017 0.007 0.014 0.008 0.007 0.0005 0.0005
W 16     414. 0.089  4.05 10.70  8.90  1.54 1.260  0.24 0.45 0.08 0.08 0.20 0.04  0.022 0.003 0.001 0.013 0.016 0.014 0.0005 0.0004
W 21 F  1722. 0.129  3.89  9.34  6.85  0.62 0.695  0.14 0.13 0.02 0.02 0.08 0.04  0.018 0.008 0.001 0.010 0.012 0.005 0.0005 0.0006
W 22    1481. 0.091  4.04  9.38  6.50  0.74 0.905  0.16 0.16 0.04 0.05 0.06 0.04  0.017 0.003 0.001 0.010 0.004 0.004 0.0005 0.0004
W 24 I  1365.-9.000 -9.00 -9.00  9.55 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.009 0.006-9.000-9.000-9.000-9.0000-9.0000
W 26    1656. 0.065  4.19  7.88  5.75  0.78 1.150  0.24 0.19 0.04-9.00-9.00 0.04  0.020 0.003 0.001 0.013 0.013 0.011 0.0005 0.0003
W 29    2323. 0.079  4.10  8.27  6.40  0.64 0.595  0.14 0.14 0.02 0.04 0.02 0.04  0.007 0.001 0.001 0.010 0.006 0.002 0.0005 0.0003
W 34    1130. 0.068  4.17  8.17  6.90  0.99 1.040  0.36 0.52 0.08 0.18 0.20 0.04  0.016 0.002 0.001 0.013 0.023 0.007 0.0005 0.0004
W 35    1183. 0.076  4.12  8.90  7.45  1.00 0.930  0.23 0.30 0.05 0.12 0.16 0.04  0.018 0.002 0.001 0.012 0.014 0.006 0.0005 0.0004
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790621

W  4 X    65. 0.100  4.00 -9.00  9.25  1.57-9.000  0.39 1.23-9.00-9.00-9.00 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W  7 I   243.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.018 0.0 [illegible]000-9.000-9.000-9.0000-9.0000
W 16     163. 0.019  4.72 -9.00  3.65  0.52 0.550  0.17 0.76-9.00 0.07 0.31 0.04  0.019 0.002 0.001 0.005 0.011 0.029 0.0005 0.0001
W 19 X   114. 0.050  4.30 -9.00  7.20  1.37-9.000  0.35-9.00 0.32-9.00-9.00 0.07  0.047 0.011 0.011 0.013 0.024 0.059 0.0005 0.0003
W 21 I   272. 0.043  4.37 -9.00  6.60  0.61 0.650  0.17 0.72 0.12 0.06-1.32 0.04  0.037 0.025 0.007 0.011 0.014 0.050 0.0005 0.0003
W 23     291. 0.035  4.45  5.60  4.00  0.60-9.000  0.34-9.00 0.12 0.17-9.00 0.04  0.023 0.004 0.002 0.006 0.012 0.024 0.0005 0.0003
W 26     403. 0.066  4.18  5.67  4.50  0.63 0.600  0.26 0.60 0.10 0.12 0.03 0.07  0.035 0.003 0.002 0.008 0.012 0.019 0.0005 0.0001
W 29     229. 0.039  4.41 -9.00  3.65  0.53 0.450  0.16 0.38 0.08 0.06 0.36 0.04  0.015 0.001 0.001 0.007 0.013 0.011 0.0005 0.0001
W 34     415. 0.040  4.40  3.53  4.60  0.72 0.910  0.85 1.10 0.17 0.38 0.71 0.04  0.031 0.008 0.003 0.008 0.032 0.038 0.0005 0.0008
W 35 X   115. 0.047  4.33 -9.00 17.25  1.44-9.000  0.44-9.00 0.68 0.27-9.00 0.06  0.099 0.072 0.044 0.039 0.044 0.103 0.0005 0.0012
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F ST P     VOL    HF    PH  ACID   SO4   NO3   NH4    CL   CA   MG   NA    K    F     FE    CU    NI    PB    ZN    AL     CR     CD

W 36 I     160. 0.030  4.52 -9.00 10.40  0.97 2.500  0.29 0.90 0.22 0.13 0.34 0.05  0.134 0.159 0.123 0.048 0.028 0.147 0.0025 0.0006
W 37       349. 0.041  4.39  5.38  3.05  0.52 0.400  0.38 0.36 0.06 0.18-9.00 0.06  0.037 0.005 0.002 0.007 0.015 0.032 0.0005 0.0004
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790623
C  2 I      91. 0.044  4.36 -9.00  3.15  0.10 0.050  0.16 0.11 0.02-9.00-9.00 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  4 I     133. 0.013  4.90 -9.00  1.35  0.09 0.190  0.23 0.17 0.03 0.05 0.09 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  5 I      61. 0.031  4.51 -9.00  2.55  0.08-9.000  0.11-9.00 0.03-9.00-9.00 0.04  0.055 0.003 0.002 0.004 0.006 0.035 0.0005 0.0001
C 21        58. 0.012  4.91 -9.00  0.70  0.12-9.000  0.21 0.20 0.04-9.00-9.00 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 24       154.-9.000 -9.00 -9.00  0.65 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.001 0.001-9.000-9.000-9.000-9.0000-9.0000
C 26       114. 0.005  5.31 -9.00  0.30  0.03-9.000  0.15 0.22 0.04 0.03 0.17 0.04  0.010 0.002 0.001 0.001 0.006 0.006 0.0005 0.0001
C 34 F     325. 0.009  5.06  1.98  0.50  0.07 0.050  0.17 0.47 0.02 0.08-9.00 0.04  0.004 0.001 0.001 0.003 0.008 0.002 0.0005 0.0002
C 35 X      62. 0.000  6.44 -9.00  0.65 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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790626
W  2 I     435. 0.045  4.35  7.16  7.65  1.37 0.660  0.32 1.75-0.42 0.07 0.13 0.04  0.045 0.002 0.001 0.014 0.020 0.052 0.0005 0.0002
W  5 I     534. 0.032  4.50 10.48  8.85  1.56 1.050 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 16 •     724. 0.072  4.14  7.59  6.55 -1.90 0.840  0.36-2.96-0.60 0.06 0.13 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 21      3646. 0.060  4.22  6.03  5.10  0.64 0.480  0.12 0.79 0.19 0.03 0.07 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 24      3366. 0.074  4.13  6.53  5.05  0.78 0.500  0.19 0.91 0.18 0.01 0.03 0.04  0.022 0.001 0.001 0.011 0.012 0.015 0.0005 0.0001
W 26 I    1875. 0.065  4.19  8.86  9.40 -1.93 0.910  0.33-2.56-0.66 0.09 0.16 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 29      1854. 0.066  4.18  4.93  5.90  1.00 0.520  0.20 1.46 0.32 0.03 0.07 0.04  0.022 0.001 0.001 0.010 0.008 0.028 0.0005 0.0001
W 35 I    1764. 0.062  4.21  6.47  8.55  1.67 0.810  0.24 1.68-0.55 0.06 0.11 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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790630
W  2 F     672. 0.102  3.99 12.72  9.50  0.82 0.810  0.22 0.10 0.03 0.08 0.06 0.04  0.014 0.001 0.001 0.025 0.008 0.005 0.0005 0.0003
W  4 F     723. 0.151  3.82 15.14 12.70  0.85 1.200  0.19 0.21 0.03 0.09 0.08 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W  5 F    1015. 0.224  3.65 14.68 11.10  0.90 0.930  0.22 0.10 0.03 0.08 0.05 0.04  0.031 0.001 0.001 0.021 0.008 0.010 0.0005 0.0003
W  7       797. 0.158  3.80 10.78  7.85  0.51 0.590  0.12 0.09 0.02 0.06 0.02 0.04  0.021 0.001 0.001 0.019 0.015 0.005 0.0005 0.0002
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F ST P   VOL    HF     PH   ACID   SO4   NO3   NH4    CL   CA   MG   NA   K    F      FE    CU    NI    PB    ZN    AL     CR     CD

W 16     999. 0.100  4.00  9.24  6.65  0.54 0.570  0.22 0.16 0.03 0.12 0.07 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 21    4767. 0.054  4.27  5.66  3.35  0.15 0.330  0.04 0.08 0.01 0.02 0.01 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 22 X  1829. 0.219  3.66 13.96 14.25  0.60 0.710  1.19 1.68 0.41 0.60 0.14 0.04  0.039 0.022 0.008 0.023 0.020 0.025 0.0005 0.0013
W 24    3271. 0.117  3.93  8.63  6.55  0.44 0.660  0.17 0.15-9.00 0.05 0.37 0.04  0.023 0.002 0.003 0.014 0.010 0.010 0.0005 0.0003
W 25    1691. 0.102  3.99  9.61  6.65  0.52 0.660  0.12 0.12 0.02 0.04 0.05 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 26 F   858. 0.115  3.94 11.39  8.55  0.44 0.680  0.12 0.12 0.02 0.07 0.03 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 29 N  2216. 0.174  3.76 11.13  8.55  0.49 0.530  0.12 0.04 0.01 0.26 0.03 0.04  0.014 0.007 0.001 0.016 0.006 0.002 0.0005 0.0003
W 34     752. 0.148  3.83 10.12  7.70  0.52 0.680  0.49 0.15 0.03 0.24 0.29 0.03  0.019 0.003 0.001 0.016 0.062 0.004 0.0005 0.0003
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790701
C  2 F  3048. 0.028  4.55  4.37  1.75  0.18 0.130  0.09 0.04 0.02 0.04 0.04 0.04  0.006 0.001 0.001 0.008 0.005 0.001 0.0005 0.0001
C  4 F  2069. 0.072  4.14  7.24  4.10  0.32 0.300  0.11 0.07 0.02 0.06 0.02 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C  5 F  1371. 0.087  4.06  6.10  3.35  0.31 0.260  0.10 0.01 0.01 0.06 0.03 0.04  0.012 0.001 0.001 0.013 0.003 0.002 0.0005 0.0001
C  7 F   429. 0.107  3.97  9.85  7.95  0.57 0.450  0.29 0.17 0.02 0.15 0.07 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 16    2899. 0.044  4.36  5.27  2.15  0.29 0.270  0.12 0.09 0.01 0.07 0.03 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 21    2801. 0.035  4.45  4.14  2.05  0.18 0.190  0.15 0.06 0.02 0.07 0.03 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 25 F   578. 0.117  3.93 11.20  9.45  0.69 0.610  0.18 0.18 0.02 0.09 0.05 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 26 F   855. 0.081  4.09  8.15  4.95  0.18 0.220  0.13 0.13 0.01 0.09 0.07 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 29 N  3881. 0.095  4.02  6.25  3.80  0.17 0.210  0.06 0.04 0.01 0.02 0.01 0.04  0.005 0.002 0.001 0.010 0.004 0.001 0.0005 0.0001
C 34    2078. 0.059  4.23  4.77  2.25  0.25 0.220  0.12 0.04 0.01 0.08 0.08 0.04  0.013 0.001 0.001 0.008 0.024 0.003 0.0010 0.0001
C 35 F   806. 0.048  4.32  5.53  2.85  0.27 0.260  0.11 0.09 0.02 0.06 0.07 0.04 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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790724
W  2    1057. 0.048  4.32  5.22  3.50  0.16 0.280  0.12 0.24 0.05 0.06 0.23 0.04  0.010 0.001 0.001 0.008 0.010 0.005 0.0005 0.0001
W  5    1328.-9.000 -9.00 -9.00  3.45 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W  7 I  2077. 0.051  4.29  6.15  3.80  0.37 0.440  0.11 0.29 0.02 0.03 0.29 0.04  0.018 0.017 0.018 0.007 0.009 0.013 0.0005 0.0002
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F ST P    VOL    HF     PH    ACID  SO4   NO3  NH4    CL   CA   MG   NA   K    F     FE    CU    NI    PB    ZN    AL    CR     CD
W 17      861. 0.078  4.11  6.14  3.40  0.53 0.380  0.12 0.19 0.05 0.06 0.02 0.04  0.016 0.001 0.001 0.009 0.014 0.009 0.0005 0.0001
W 19      647. 0.074  4.13  6.96  4.20  0.61 0.380  0.19 0.38 0.08 0.08 0.04 0.04  0.093 0.004 0.002 0.011 0.028 0.063 0.0005 0.0002
W 21 I   1309. 0.076  4.12  5.86  4.25  0.33 0.400  0.09 0.20 0.17 0.02 0.02 0.04  0.046 0.025 0.011 0.011 0.014 0.013 0.0010 0.0005
W 22     2702. 0.072  4.14  5.74  3.35  0.35 0.320  0.08 0.06 0.01 0.06 0.01 0.04  0.008 0.001 0.001 0.007 0.007 0.007 0.0005 0.0002
W 23     1770. 0.066  4.18  6.12  3.65  0.44 0.320  0.25 0.27 0.05 0.08 0.05 0.04  0.072 0.006 0.002 0.008 0.027 0.094 0.0010 0.0006
W 24      840. 0.049  4.31  4.44  3.10  0.39 0.490  0.14 0.24 0.05 0.08 0.16 0.04  0.011 0.003 0.001 0.007 0.011 0.006 0.0005 0.0001
W 26      653. 0.063  4.20  5.53  4.15  0.60 0.630  0.02 0.42 0.04 0.22 0.15 0.04  0.028 0.005 0.009 0.008 0.019 0.014 0.0005 0.0001
W 28     1148. 0.081  4.09  7.42  4.35  0.67 0.500  0.18 0.33 0.07 0.08 0.06 0.04  0.072 0.003 0.001 0.012 0.032 0.089 0.0005 0.0003
W 29     3558. 0.066  4.18  5.54  4.00  0.45 0.550  0.12 0.08 0.02 0.03 0.05 0.04  0.008 0.004 0.001 0.009 0.012 0.005 0.0005 0.0001
W 35 I    913. 0.087  4.06  6.94  5.45  0.77 0.590  0.21-9.00 0.01 0.18 0.18 0.04  0.027 0.006 0.003 0.018 0.027 0.028 0.0010 0.0002
W 36 I   1878. 0.063  4.20  5.41  3.95  0.30 0.280  0.08 0.13 0.04 0.04 0.03 0.04  0.109 0.042 0.019 0.010 0.012 0.079 0.0005 0.0002
W 37     1722. 0.069  4.16  5.52  3.35  0.45 0.280  0.38 0.37 0.04 0.08 0.05 0.04  0.110 0.003 0.001 0.008 0.019 0.086 0.0010 0.0001
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790725

C  2      439. 0.039  4.41  3.41  1.45  0.15 0.120  0.04 0.01 0.01 0.02 0.01 0.04  0.002 0.001 0.001 0.003 0.006 0.009 0.0005 0.0001
C  4 F   2671. 0.048  4.32  5.33  3.70  0.35 0.300  0.14 0.09 0.05 0.07 0.41 0.04  0.007 0.002 0.001 0.014-9.000-9.000-9.0000-9.0000
C  5 F   1345. 0.087  4.06  6.83  4.25  0.48 0.560  0.13 0.07 0.02 0.06 0.05 0.04  0.027 0.001 0.001 0.009 0.027 0.119 0.0020-9.0000
C  7 I   5037. 0.055  4.26  6.56  3.15  0.29 0.280  0.07 0.05 0.02 0.03 0.01 0.04  0.008 0.002 0.001 0.007 0.006 0.005 0.0005 0.0001
C 16 X   2632. 0.089  4.05  7.72  5.25  0.51 0.480  0.10 0.06 0.01 0.05 0.05 0.04  0.007 0.001 0.001 0.009 0.007 0.005 0.0005 0.0001
C 17 N   1532. 0.072  4.14  5.69  3.10  0.24 0.200  0.04 0.04 0.01 0.03 0.01 0.04  0.010 0.007 0.001 0.005 0.005 0.006 0.0005 0.0003
C 19 F   2951. 0.093  4.03  6.92  4.35  0.42 0.340  0.09 0.05 0.01 0.05 0.01 0.04  0.013 0.003 0.001 0.008 0.012 0.006 0.0005 0.0002
C 21 I   2129. 0.054  4.27  4.34  2.55  0.11 0.140  0.04 0.03 0.04 0.01 0.01 0.04  0.007 0.008 0.001 0.005 0.006 0.005 0.0005 0.0002
C 22 N   1595. 0.079  4.10  6.42  4.40  0.38 0.360  0.07 0.07 0.02 0.04 0.03 0.04  0.019 0.002 0.001 0.007 0.012 0.008 0.0005 0.0002
C 23 F   3423. 0.068  4.17  6.73  4.45  0.38 0.330  0.14 0.07 0.02 0.08 0.04 0.04  0.029 0.008 0.002 0.008 0.041 0.010 0.0005 0.0005
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P  VOL    HF     PH   ACID  SO4   NO3  NH4    CL   CA   MG   NA   K    F     FE    CU    NI    PB    ZN    AL    CR     CD
C 24     914. 0.028  4.55  2.71  1.45  0.08 0.110  0.04 0.02 0.04 0.01 0.02 0.04  0.005 0.003 0.001 0.003 0.008 0.006 0.0005 0.0001
C 26 F   898. 0.078  4.11  6.81  4.10  0.38 0.360  0.08 0.04 0.04 0.02 0.01 0.04  0.013 0.004 0.001 0.008 0.009 0.005 0.0005 0.0001
C 28 N  3210. 0.083  4.08  6.41  4.80  0.36 0.380  0.29 0.06 0.03 0.07 0.03 0.04  0.052 0.069 0.019 0.011 0.022 0.009 0.0005 0.0007
C 29 N   673. 0.060  4.22  4.76  2.75  0.31 0.190  0.07 0.03 0.02 0.01 0.01 0.04  0.006 0.003 0.001 0.004 0.009 0.005 0.0005 0.0001
C 30 N  2897. 0.105  3.98  8.19  5.35  0.46 0.420  0.10 0.04 0.01 0.07 0.02 0.03  0.038 0.017 0.004 0.014 0.021 0.017 0.0005 0.0006
C 34    6788. 0.034  4.47  3.52  2.65  0.24 0.260  0.63 0.19 0.03 0.46 0.26 0.04  0.001 0.002 0.003 0.006 0.010 0.005 0.0005 0.0001
C 35 I  2852. 0.081  4.09  6.67  4.55  0.40 0.340  0.09-9.00 0.05 0.09 0.01 0.04  0.010 0.004 0.001 0.011 0.008 0.005 0.0005 0.0001
C 36 N  1857. 0.051  4.29  5.92  4.20  0.28 0.540  0.06 0.03 0.03 0.05 0.01 0.04  0.012 0.007 0.003 0.008 0.012 0.005 0.0005 0.0001
C 37 N  3333. 0.129  3.89  8.64  6.20  0.42 0.420  0.20 0.13 0.03 0.12 0.06 0.04  0.058 0.068 0.031 0.015 0.056 0.017 0.0005 0.0008
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790728
W  4     509. 0.052  4.28  5.50  5.50  0.80 0.730  0.16 0.98 0.08 0.01 0.08 0.03  0.020 0.004 0.001 0.040 0.013 0.024 0.0005 0.0001
W 16    1588. 0.065  4.19  6.81  5.50  0.44 0.680  0.27 0.19 0.01 0.09 0.09 0.04  0.032 0.013 0.003 0.011 0.012 0.027 0.0005 0.0004
W 19 X    89. 0.141  3.85 -9.00 18.15  2.65-9.000  1.11-9.00-9.00-9.00-9.00 0.10 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 21 I   293.-9.000 -3.64 -9.00 11.80  1.20 0.640  0.24-9.00 0.01-9.00 0.03 0.05  0.044 0.017 0.007 0.032 0.018 0.011 0.0005 0.0004
W 28 X    62.-9.000 -9.00 -9.00 18.70  2.31-9.000  0.88-9.00-9.00-9.00-9.00 0.16 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
W 36 X    89. 0.331  3.48 -9.00 28.35  3.52-9.000  0.98-9.00-9.00-9.00-9.00 0.16 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
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790801
C 16 X  4873. 0.013  4.87  1.96  7.10  0.09 0.100  0.62 0.02 0.01 0.01 0.01 0.00  0.002 0.002 0.001 0.002 0.007 0.005 0.0005 0.0001
C 17 N   958. 0.023  4.64  2.85  1.20  0.22 0.060  0.06 0.16 0.12 0.01 0.01 0.04  0.053 0.011 0.004 0.004 0.016 0.025 0.0010 0.0002
C 19 F   787. 0.009  5.05  2.15  0.85  0.26 0.190  0.11 0.23 0.05 0.05 0.08 0.04  0.104 0.008 0.004 0.008 0.026 0.061 0.0020 0.0005
C 22 N   721. 0.058  4.24  4.41  2.60  0.22 0.110  0.08 0.15 0.06 0.01 0.01 0.04  0.010 0.037 0.009 0.005 0.007 0.005 0.0005 0.0002
C 23 F   749. 0.015  4.82  2.36  0.90  0.30 0.070  0.36 0.36 0.02 0.09 0.05 0.04  0.136 0.010 0.004 0.007 0.029 0.098 0.0025 0.0006
C 24 N    93. 0.032  4.49 -9.00  2.30  0.50 0.770  0.08-9.00-9.00-9.00-9.00 0.03 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 25 N   893. 0.030  4.53  3.41  2.30  0.12 0.230  0.24 0.20 0.06 0.12 0.33 0.04  0.020 0.025 0.009 0.004 0.049 0.001 0.0005 0.0005
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P   VOL    HF     PH    ACID  SO4   NO3   NH4    CL   CA   MG   NA   K    F      FE    CU    NI    PB    ZN    AL     CR     CD
C 26    1665. 0.021  4.67  2.89  1.00  0.09 0.100  0.03 0.06 0.03 0.01 0.01 0.04  0.005 0.003 0.001 0.003 0.003 0.001 0.0005 0.0001
C 28 F   659. 0.020  4.69  2.36  0.85  0.31 0.150  0.11 0.27 0.10 0.05 0.04 0.04  0.048 0.010 0.004 0.006 0.017 0.021 0.0015 0.0005
C 29 N   875. 0.032  4.49 -9.00  1.30 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.009 0.001-9.000-9.000-9.000-9.0000-9.0000
C 34 X   919. 0.026  4.58  3.68  2.05  0.20 0.370  0.17 0.17 0.04 0.05 0.10 0.04  0.013 0.003 0.001 0.008 0.014 0.004 0.0005 0.0003
C 35 F  1215. 0.044  4.36  3.62  1.50  0.15 0.090  0.07 0.10 0.01 0.02 0.01 0.00  0.007 0.003 0.001 0.004 0.009 0.002 0.0005 0.0002
C 36 N  1062. 0.041  4.39  3.96  1.90  0.19 0.030  0.05 0.11 0.01 0.01 0.01 0.04  0.081 0.006 0.002 0.007 0.015 0.032 0.0015 0.0003
C 37     913. 0.017  4.76  2.43  1.30  0.23 0.200  0.11 0.19 0.35 0.01 0.01 0.04  0.060 0.006 0.001 0.004 0.013 0.065 0.0010 0.0003
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790802
C  2 N  2437. 0.016  4.80  2.28  0.60  0.06 0.050  0.04 1.02 0.01 0.01 0.01 0.04  0.021 0.005 0.001 0.024 0.016 0.021 0.0010 0.0001
C  4 N  1326. 0.028  4.55  3.38  1.70  0.06 0.140  0.10 0.02 0.02 0.01 0.01 0.04  0.012 0.023 0.005 0.004 0.009 0.005 0.0005 0.0003
C  5 N   634. 0.021  4.68  3.51  2.05  0.11 0.280  0.53 0.15 0.01 0.20 0.22 0.04  0.027 0.011 0.005 0.004 0.100 0.010 0.0005 0.0010
C 16 F   878. 0.026  4.58  2.63  2.05  0.23 0.050  0.10 0.05 0.01 0.01 0.01 0.02  0.009 0.001 0.002 0.001 0.006 0.005 0.0005 0.0001
C 17 I   627. 0.048  4.32  4.99  3.00  0.15 0.010  0.17 0.10 0.07 0.08 0.04 0.04  0.013 0.011 0.004 0.004 0.032 0.005 0.0005 0.0005
C 19 I  1293. 0.024  4.62  3.01  1.40  0.11 0.080  0.07 0.06 0.01 0.02 0.02 0.04  0.038 0.007 0.004 0.004 0.061 0.013 0.0050 0.0003
C 21     252.-9.000 -9.00 -9.00  0.80 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.002 0.001-9.000-9.000-9.000-9.0000-9.0000
C 22     513. 0.042  4.38  3.41  1.70  0.18 0.710  0.10 0.18 0.01 0.02 0.02 0.04  0.010 0.003 0.001 0.003 0.006 0.005 0.0005 0.0001
C 23 I  1143. 0.047  4.33  4.54  3.55  0.11 0.230  0.14 0.08 0.09 0.03 0.02 0.04  0.220 0.280 0.065 0.036 0.038 0.026 0.0015-0.0051
C 28 I  1187. 0.025  4.60  2.82  2.25  0.08 0.460  0.05 0.06 0.06 0.01 0.01 0.04  0.044 0.069 0.017 0.007 0.040 0.010 0.0045 0.0005
C 35     609. 0.037  4.43  3.21  1.35  0.15 0.070  0.07 0.05 0.01 0.03 0.01 0.00  0.010 0.011 0.003 0.004 0.011 0.005 0.0005 0.0002
C 36     258. 0.028  4.56 -9.00  1.20  0.29 0.170  0.51-9.00 0.03-9.00-9.00 0.04  0.035 0.008 0.006 0.005 0.070 0.026 0.0025 0.0007
C 37 N  1403. 0.026  4.59  3.74  2.20  0.08 0.180  0.17 0.10 0.04 0.09 0.04 0.04  0.048 0.020 0.007 0.007 0.036 0.024 0.0005 0.0009
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790806
C  5 X  1196. 0.012  4.92  2.12  8.25  0.65 0.220  0.17 0.25 0.03 0.03 0.10 0.08  0.053 0.005 0.001 0.004 0.007 0.029 0.0005 0.0001
C  7 I  2126. 0.020  4.69  2.90  2.05  0.03 0.010  0.05 0.33 0.13 0.04 0.36 0.04  0.046 0.006 0.006 0.003 0.057 0.013-0.0065 0.0003
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS
F ST P    VOL    HF     PH    ACID   SO4    NO3   NH4    CL   CA   MG   NA   K    F      FE    CU    NI    PB    ZN    AL     CR     CD
C 16     1599. 0.032  4.50  3.16  1.30   0.19 0.240  0.07 0.24 0.03 0.02 0.04 0.00  0.014 0.005 0.002 0.004 0.014 0.006 0.0010 0.0002
C 21 I   1747. 0.058  4.24  4.32  2.80   0.21 0.260  0.10 0.27 0.02 0.04 0.06 0.04  0.015 0.005 0.001 0.003 0.002 0.009 0.0005 0.0002
C 24     1662. 0.011  4.95  2.64  1.00   0.20 0.660  0.06 0.16 0.02 0.05 0.06 0.01  0.012 0.001 0.001 0.002 0.003 0.009 0.0005 0.0001
C 25 X    860. 0.000  7.15 -9.00  1.50 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.001 0.001-9.000-9.000-9.000-9.0000-9.0000
C 26     1306. 0.015  4.82  2.30  1.15   0.15 0.160  0.05 0.23 0.02 0.03 0.03 0.04  0.013 0.015 0.004 0.004 0.005 0.001 0.0005 0.0003
C 29     3447. 0.020  4.69  2.36  0.95   0.13 0.170  0.07 0.12 0.05 0.01 0.01 0.04  0.007 0.001 0.001 0.002 0.003 0.001 0.0010 0.0001
C 34     2450.-9.000 -9.00 -9.00  0.75 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.003 0.001-9.000-9.000-9.000-9.0000-9.0000
C 35     1521. 0.004  5.45 -9.00  0.95 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.003 0.003-9.000-9.000-9.000-9.0000-9.0000
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790809
C  5      634. 0.028  4.55  4.04  0.95   0.14 0.080  0.08 0.07 0.01 0.05 0.04 0.04  0.059 0.005 0.002 0.005 0.008 0.018 0.0005 0.0001
C 16      630. 0.013  4.88  3.02  1.50   0.20 0.130  0.02 0.09 0.01 0.02 0.03 0.04  0.007 0.002 0.001 0.003 0.006 0.005 0.0005 0.0001
C 17     1365. 0.022  4.66  2.83  0.80   0.13 0.070  0.02 0.07 0.16 0.01 0.01 0.04  0.010 0.003 0.001 0.005 0.001 0.001 0.0005 0.0001
C 19      554. 0.021  4.68  2.65  1.05   0.17 0.120  0.16 0.20 0.37 0.10 0.05 0.04  0.089 0.006 0.004 0.008 0.081 0.043 0.0070 0.0002
C 21 I    199. 0.026  4.59 -9.00  2.50 -1.74-9.000  0.48-9.00 0.02 0.03 0.01-0.18 -9.000-9.000-9.000-9.000-9.000-9.000-9.0000-9.0000
C 22 I    738. 0.015  4.83  2.59  1.30   0.12 0.160  0.13 0.12 0.02 0.04 0.10 0.01  0.036 0.017 0.020 0.005 0.039 0.005 0.0045 0.0002
C 26      437. 0.025  4.60  2.77  1.00   0.18 0.140  0.05 0.08 0.01 0.03 0.05 0.04  0.023 0.003 0.001 0.006 0.006 0.003 0.0005 0.0001
C 28      656. 0.025  4.60  2.76  1.00   0.17 0.110  0.15 0.09 0.05 0.07 0.11 0.04  0.057 0.005 0.001 0.005 0.004 0.015 0.0005 0.0001
C 29 I    744. 0.030  4.53  2.80  0.95   0.17 0.070  0.03 0.10 0.01 0.01 0.01 0.02  0.005 0.001 0.001 0.004 0.002 0.005 0.0005 0.0001
C 34      740. 0.035  4.46  2.99  1.30   0.16 0.130  0.14 0.06 0.01 0.05 0.16 0.01  0.041 0.001 0.002 0.004 0.065 0.010 0.0060 0.0001
C 35      334. 0.036  4.44  3.24 -9.00   0.22 0.170  0.10 0.19 0.01 0.02 0.05 0.00  0.017 0.004 0.002 0.009 0.019 0.006 0.0010 0.0001
C 37      761.-9.000 -9.00 -9.00  1.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.004 0.001-9.000-9.000-9.000-9.0000-9.0000
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790817
W  5      841. 0.115  3.94  8.60  5.00   1.04 0.580  0.24 0.43 0.07 0.05 0.07 0.00  0.201 0.002 0.001 0.021 0.024 0.108 0.0005 0.0001
W 19     1268. 0.087  4.06 10.31  6.35   1.38 2.500  1.52 0.42-9.00 0.06 1.48 0.16  0.129 0.003 0.001 0.020 0.017 0.078 0.0010 0.0002
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F	ST	P	VOL	HF	PH	ACID	SO4	NO3	NH4	CL	CA	MG	NA	K	F	FE	CU	NI	PB	ZN	AL	CR	CD
W	21	I	1615.	0.126	3.90	9.81	6.20	0.84	0.400	0.19	0.26	0.03	0.01	0.01	0.09	0.088	0.061	0.016	0.026	0.013	0.007	0.0005	0.0010
W	24		1521.	-9.000	-9.00	-9.00	-9.00	-9.00	-9.000	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	0.027	0.004	0.001	0.029	0.012	0.020	0.0005	0.0002
W	26	X	1233.	-9.000	-9.00	-9.00	-9.00	-9.00	-9.000	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	0.039	0.016	0.009	0.025	0.008	0.007	0.0005	0.0012
W	28		879.	0.151	3.82	11.59	5.35	1.34	0.560	0.21	0.47	0.07	0.03	0.01	0.02	0.053	0.002	0.001	0.014	0.017	0.032	0.0005	0.0001
W	35		1010.	0.120	3.92	8.67	5.05	1.11	0.540	0.19	0.37	0.05	0.03	0.04	0.04	0.027	0.003	0.001	0.017	0.019	0.009	0.0050	0.0001
W	36	I	1314.	0.182	3.74	12.29	7.90	1.20	0.680	0.23	0.46	0.08	0.05	0.03	0.11	0.212	0.027	0.057	0.046	0.031	0.050	0.0010	0.0006
W	37		736.	0.110	3.96	10.21	5.60	1.46	0.680	0.49	0.62	0.09	0.06	0.04	0.09	0.141	0.003	0.002	0.018	0.022	0.094	0.0010	0.0002
790820																							
C	2	X	216.	0.085	4.07	-9.00	9.30	0.54	0.390	0.21	-9.00	0.01	0.07	0.98	0.14	0.087	0.009	0.004	0.012	0.069	0.054	0.0040	0.0004
C	5	•	589.	0.091	4.04	10.08	8.50	0.18	0.420	0.12	0.18	0.03	0.07	0.11	0.04	0.084	0.037	0.012	0.020	0.004	0.034	0.0005	0.0008
C	17		1767.	0.035	4.46	3.90	1.10	0.07	0.160	0.33	0.04	0.01	0.03	0.02	0.00	0.013	0.007	0.003	0.004	0.009	0.005	0.0005	0.0001
C	19	I	251.	0.123	3.91	-9.00	4.85	0.47	-9.000	0.63	-9.00	0.05	0.09	-9.00	-9.00	0.270	0.093	0.051	0.021	0.015	0.024	0.0005	0.0011
C	21	I	4589.	0.107	3.97	6.83	4.65	0.12	0.130	0.08	0.06	0.01	0.01	0.01	0.05	0.034	0.010	0.001	0.012	0.008	0.011	0.0005	0.0008
C	23	I	321.	0.200	3.70	-9.00	4.55	1.14	0.700	0.32	0.44	0.06	0.19	-9.00	0.05	0.270	0.137	0.066	0.023	0.021	0.032	0.0010	0.0011
C	28	I	732.	0.166	3.78	11.54	8.90	0.22	0.390	0.16	0.18	0.03	0.02	0.01	0.06	0.102	0.133	0.039	0.017	0.014	0.020	0.0005	0.0008
C	29		856.	0.032	4.50	3.06	1.15	0.08	0.190	0.09	0.05	0.01	0.05	0.02	0.11	0.007	0.001	0.001	0.004	0.007	0.005	0.0005	0.0001
C	35	I	765.	-9.000	-9.00	-9.00	-9.00	-9.00	-9.000	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	0.107	0.034	0.017	0.027	0.002	0.023	0.0005	0.0008
C	36	I	487.	0.098	4.01	6.27	2.00	0.14	0.270	0.18	-9.00	0.02	-9.00	-9.00	0.07	-0.500	0.048	0.027	0.013	0.016	0.118	0.0015	0.0004
790822																							
W	5		2278.	0.091	4.04	6.16	4.15	0.50	0.180	0.14	0.21	0.06	0.03	0.05	0.02	0.036	0.002	0.001	0.011	0.002	0.017	0.0005	0.0001
W	7	I	440.	-9.000	-9.00	-9.00	-9.00	-9.00	-9.000	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	0.082	0.065	0.029	0.018	0.046	0.014	0.0005	0.0006
W	16		1265.	0.091	4.04	7.60	5.25	0.62	0.240	0.18	0.33	0.06	0.01	0.05	0.02	0.035	0.006	0.002	0.014	0.010	0.016	0.0005	0.0002
W	19		2128.	0.105	3.98	6.30	5.10	0.21	0.220	0.39	0.36	0.06	0.02	0.01	0.22	0.045	0.001	0.001	0.007	0.008	0.015	0.0005	0.0001
W	23		1969.	0.087	4.06	5.83	4.70	0.24	0.160	0.57	0.43	0.07	0.01	0.01	0.15	0.076	0.002	0.001	0.007	0.009	0.048	0.0005	0.0001

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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F ST P   VOL    HF     PH   ACID   SO4   NO3   NH4    CL   CA   MG   NA    K    F     FE    CU    NI    PB    ZN    AL     CR     CD
W 24 I   263.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.065 0.018 0.006 0.014 0.002 0.035 0.0005 0.0002
W 28    2020. 0.087  4.06  5.54  3.25  0.52 0.150  0.14 0.33 0.05 0.02 0.02 0.01  0.026 0.002 0.001 0.005 0.008 0.012 0.0005 0.0001
W 29     607. 0.100  4.00  6.45  4.55  0.77 0.170  0.21 0.93 0.13 0.01 0.06 0.03  0.070 0.001 0.001 0.007 0.005 0.049 0.0005 0.0001
W 34     861.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.011 0.002 0.001 0.010 0.012 0.005 0.0005 0.0002
W 36 I  1121. 0.051  4.29 -9.00  7.90 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.173 0.042-9.000-9.000-9.000-9.0000-9.0000
W 37    1618. 0.095  4.02  5.69  3.45  0.50 0.170  0.46 0.58 0.08 0.05 0.02 0.04  0.129 0.002 0.001 0.007 0.010 0.096 0.0005 0.0001
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790823

W  2    3688. 0.048  4.32 -9.00  4.70 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00 -9.000 0.001 0.001-9.000-9.000-9.000-9.0000-9.0000
W  4    1966.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.006 0.001 0.001 0.011 0.002 0.005 0.0005 0.0001
W  5    1955. 0.091  4.04  8.36  6.05  0.72 0.780  0.15 0.71 0.04 0.03 0.09 0.02  0.021 0.007 0.001 0.017 0.006 0.007 0.0005 0.0002
W  7 N  2286.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.094 0.068 0.033 0.020 0.018 0.018 0.0005 0.0004
W 16    2921. 0.112  3.95  9.74  6.80  0.92 0.670  0.15 0.25 0.01 0.01 0.05 0.03  0.019 0.002 0.001 0.016 0.011 0.009 0.0005 0.0001
W 19    1773.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.021 0.002 0.001 0.016 0.002 0.008 0.0005 0.0001
W 22 I  1492. 0.148  3.83 13.32  9.50  0.99 0.670  0.20 0.17 0.02 0.01 0.03 0.04  0.024 0.002 0.001 0.023 0.002 0.012 0.0005 0.0003
W 23    1546. 0.105  3.98  9.21  6.10  0.72 0.430  0.12 0.27 0.03 0.01 0.02 0.02  0.012 0.001 0.001 0.014 0.002 0.003 0.0005 0.0001
W 24 N   858.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.038 [illegible] 0.018 0.042 0.008 0.023 0.0005 0.0006
W 26 X    -9.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.026 0.002 0.001 0.019 0.004 0.007 0.0005 0.0001
W 29 I   662. 0.191  3.72 16.93 11.75  1.58 0.900  0.32 0.34-9.00 0.01 0.03 0.00  0.035 0.001 0.001 0.023 0.012 0.040 0.0005 0.0001
W 34    2382. 0.093  4.03  6.78  5.75  0.54 0.520  0.77 0.18 0.02 0.23 0.20 0.12  0.013 0.002 0.001 0.012 0.016 0.006 0.0005 0.0002
W 35 F  2765.-9.000 -9.00 -9.00 -9.00 -9.00-9.000 -9.00-9.00-9.00-9.00-9.00-9.00  0.039 0.002 0.001 0.016 0.002 0.016 0.0005 0.0001
W 36 N  2254. 0.107  3.97 11.05  8.30  0.70 0.490  0.18 0.14 0.02 0.04 0.03 0.05  0.133 0.115 0.043 0.037 0.006 0.013 0.0005 0.0021
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790827

C  2 N   706. 0.046  4.34  4.08  4.15  0.40 0.540  0.26 0.33 0.04 0.11 0.09 0.02  0.048 0.001 0.001 0.017 0.004 0.027 0.0005 0.0001
C  5 +   614. 0.059  4.23  4.70  5.40  0.38 0.820  0.12 0.36 0.05 0.06 0.10 0.02  0.099 0.016 0.004 0.018 0.014 0.072 0.0005 0.0003
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INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F	ST	P	VOL	HF	PH	ACID	SO4	NO3	NH4	CL	CA	MG	NA	K	F	FE	CU	NI	PB	ZN	AL	CR	CD
C	7	I	1381.	0.062	4.21	4.86	4.40	0.35	0.430	0.09	0.33	0.06	0.01	0.26	0.02	0.055	0.035	0.014	0.009	0.008	0.025	0.0005	0.0002
C	16	•	683.	0.089	4.05	7.52	6.65	0.39	0.470	0.11	0.31	0.04	-9.00	0.07	0.03	0.063	0.039	0.009	0.021	0.024	0.027	0.0005	0.0007
C	17	N	577.	0.072	4.14	6.74	5.65	0.51	0.620	0.12	0.32	0.03	0.01	0.03	0.04	0.025	0.006	0.001	0.014	0.002	0.011	0.0005	0.0001
C	19	N	935.	0.074	4.13	7.67	6.70	0.36	0.580	0.24	0.42	0.04	0.28	0.10	0.00	0.083	0.260	0.176	0.079	0.008	0.020	0.0005	0.0029
C	22	N	787.	0.045	4.35	4.67	3.90	0.29	0.430	0.15	0.24	0.04	0.04	0.10	0.02	0.240	0.026	0.019	0.016	0.002	0.096	0.0015	0.0001
C	23	N	821.	0.035	4.46	5.73	6.20	0.36	0.760	0.26	0.33	0.08	0.09	0.09	0.03	0.144	0.290	0.158	0.054	0.008	0.063	0.0005	0.0019
C	24		490.	0.026	4.59	2.75	2.15	0.21	0.230	0.36	0.30	0.06	0.12	0.24	0.01	0.026	0.003	0.001	0.006	0.015	0.022	0.0005	0.0001
C	26	•	913.	0.105	3.98	8.13	6.80	0.37	0.460	0.17	0.21	0.01	0.03	0.01	0.07	0.083	0.068	0.043	0.036	0.017	0.036	0.0005	0.0013
C	29	N	590.	0.055	4.26	5.14	3.80	0.39	0.400	0.12	0.40	0.06	0.07	0.04	-0.21	0.024	0.003	0.002	0.010	0.005	0.014	0.0005	0.0002
C	34	X	465.	0.098	4.01	5.78	5.65	0.41	0.650	0.48	0.58	0.08	0.07	0.10	-0.12	-0.144	0.008	0.001	0.014	0.010	-0.134	0.0005	0.0003
C	36	N	1353.	0.038	4.42	4.24	3.30	0.29	0.360	0.09	0.21	0.04	0.05	0.04	0.02	0.064	0.012	0.007	0.015	0.002	0.026	0.0005	0.0001
C	37	N	557.	0.062	4.21	6.43	5.40	0.46	0.640	0.23	0.30	0.04	0.04	0.05	0.03	0.071	0.063	0.025	0.027	0.004	0.046	0.0005	0.0003
790829																							
W	4		807.	0.078	4.11	6.36	4.60	0.59	0.470	0.15	0.16	0.08	0.02	0.05	0.03	0.015	0.001	0.001	0.009	0.005	0.022	0.0005	0.0001
W	5	I	721.	0.091	4.04	6.78	6.15	0.73	0.880	0.20	0.34	0.05	0.03	0.06	0.02	0.035	0.006	0.001	0.014	0.029	0.023	0.0005	0.0002
W	17		2567.	0.069	4.16	5.21	3.90	0.41	0.380	0.08	0.38	0.02	0.01	0.01	0.02	0.002	0.001	0.001	0.009	0.006	0.005	0.0005	0.0001
W	19	I	2066.	0.100	4.00	7.27	6.20	0.81	0.800	0.18	0.36	0.04	0.02	0.03	0.03	0.032	0.019	0.006	0.019	0.013	0.012	0.0005	0.0004
W	22		3026.	0.056	4.25	4.51	3.25	0.27	0.320	0.06	0.11	0.01	0.01	0.01	0.02	0.003	0.001	0.001	0.008	0.009	0.005	0.0005	0.0001
W	23		2194.	0.072	4.14	5.57	3.95	0.46	0.430	0.20	0.26	0.02	0.01	0.02	0.02	0.003	0.007	0.003	0.010	0.011	0.005	0.0005	0.0001
W	24		1362.	0.091	4.04	7.33	5.35	0.63	0.580	0.20	0.22	0.02	0.01	0.01	0.03	0.021	0.003	0.001	0.012	0.011	0.010	0.0005	0.0001
W	26	I	940.	0.074	4.13	6.39	4.95	0.37	0.320	0.09	0.10	0.02	0.02	0.03	0.02	0.065	0.022	0.007	0.015	0.023	0.011	0.0005	0.0005
W	28		2169.	0.046	4.34	4.41	5.20	0.62	1.250	0.30	0.27	0.04	0.01	0.34	0.02	0.002	0.002	0.002	0.010	0.013	0.005	0.0005	0.0001
W	29		2463.	0.069	4.16	5.81	4.35	0.42	0.500	0.08	0.17	0.01	0.01	0.01	0.03	0.016	0.001	0.001	0.012	0.008	0.005	0.0005	0.0001

INCO & FALRG OPERATING PERIOD SELECTED EVENTS

F	ST	P	VOL	HF	PH	ACID	SO4	NO3	NH4	CL	CA	MG	NA	K	F	FE	CU	NI	PB	ZN	AL	CR	CD
W	35	I	892.	0.087	4.06	5.94	4.70	0.40	0.420	0.11	0.11	0.01	0.01	0.02	0.02	0.039	0.027	0.005	0.018	0.017	0.009	0.0005	0.0002
W	36	I	3708.	0.069	4.16	4.55	3.20	0.29	0.280	0.02	0.16	0.01	0.02	0.01	0.12	0.025	0.035	0.014	0.012	0.005	0.005	0.0005	0.0003
W	37		1864.	0.091	4.04	6.84	5.30	0.63	0.610	0.25	0.30	0.03	0.01	0.01	0.03	0.018	0.002	0.001	0.012	0.024	0.005	0.0005	0.0001
790910																							
C	7		605.	0.026	4.59	2.84	1.90	0.28	0.340	0.01	0.17	0.03	0.02	0.06	0.01	0.010	0.001	0.001	0.006	0.004	0.005	0.0005	0.0001
C	16	F	2852.	0.034	4.47	3.17	2.10	0.35	0.260	0.06	0.20	0.03	0.01	0.02	0.01	0.070	0.001	0.001	0.009	0.006	0.081	0.0005	0.0001
C	17		2333.	0.030	4.53	3.42	2.35	0.45	0.400	0.08	0.38	0.06	0.05	0.03	0.02	0.040	0.001	0.001	0.007	0.004	0.034	0.0005	0.0002
C	19	I	1158.	0.041	4.39	4.10	3.30	0.36	0.590	0.08	0.19	0.02	0.04	0.02	0.02	0.052	0.034	0.007	0.018	0.008	0.012	0.0005	0.0027
C	22		992.	0.022	4.66	3.38	2.10	0.33	0.380	0.10	0.24	0.02	0.06	0.05	0.01	0.043	0.002	0.002	0.009	0.005	0.066	0.0005	0.0001
C	23	I	1080.	0.034	4.47	4.03	4.15	0.34	0.880	0.09	0.24	0.02	0.05	0.03	0.01	0.088	0.035	0.021	0.010	0.004	0.007	0.0005	0.0003
C	24		517.	0.029	4.54	2.82	2.00	0.32	0.430	0.08	0.14	0.02	0.05	0.04	0.00	0.022	0.002	0.001	0.008	0.003	0.005	0.0005	0.0001
C	25		827.	0.001	6.27	-9.00	1.90	-9.00	-9.000	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	-9.000	0.002	0.001	-9.000	-9.000	-9.000	-9.0000	-9.0000
C	28	I	1243.	0.022	4.66	2.88	2.70	0.29	0.590	0.05	0.19	0.02	0.04	0.01	0.01	0.057	0.050	0.068	0.010	0.005	0.007	0.0005	0.0003
C	34	+	1764.	0.028	4.56	2.82	2.40	0.27	0.490	0.09	0.11	0.02	0.06	0.04	0.00	0.019	0.001	0.001	0.009	0.003	0.009	0.0005	0.0001
C	36		877.	0.020	4.69	2.65	1.85	0.23	0.320	0.20	0.19	0.02	0.14	0.08	0.01	0.024	0.002	0.004	0.008	0.040	0.012	0.0010	0.0003
C	37		1311.	0.023	4.64	2.87	1.85	0.28	0.290	0.08	0.37	0.02	0.03	0.34	0.01	0.015	0.001	[illegible]	0.006	0.006	0.007	0.0005	0.0001
791011																							
C	2		2319.	0.069	4.16	4.96	1.70	0.82	0.252	0.06	0.11	0.02	0.01	0.01	0.01	0.019	0.001	0.001	0.018	0.002	0.007	0.0005	0.0001
C	5		1291.	0.063	4.20	5.81	1.90	0.95	0.275	0.29	0.21	0.03	0.05	0.14	0.02	0.023	0.002	0.001	0.015	0.048	0.005	0.0005	0.0001
C	19		2035.	0.048	4.32	4.93	1.65	0.75	0.242	0.06	0.10	0.02	0.03	0.03	0.01	0.041	0.005	0.003	0.016	0.017	0.017	0.0025	0.0002
C	21	N	958.	0.076	4.12	5.89	2.15	0.97	0.264	0.10	0.22	0.03	0.01	0.05	0.02	0.037	0.012	0.005	0.019	0.002	0.020	0.0005	0.0003
C	23		2856.	0.042	4.38	3.75	1.75	0.58	0.188	0.17	0.45	0.08	0.02	0.04	0.01	0.022	0.009	0.005	0.014	0.002	0.009	0.0005	0.0001
C	24	I	2314.	0.045	4.35	4.05	1.95	0.41	0.237	0.11	0.10	0.02	0.10	0.06	0.01	0.024	0.012	0.010	0.012	0.002	0.015	0.0005	0.0001
C	25	I	2654.	0.058	4.24	5.51	4.70	0.46	0.730	0.05	0.09	0.04	0.04	0.12	0.01	0.081	0.065	0.057	0.035	0.002	0.005	0.0015	0.0002

INCO & FALBG OPERATING PERIOD SELECTED EVENTS

F	ST	P	VOL	HF	PH	ACID	SO4	NO3	NH4	CL	CA	MG	NA	K	F	FE	CU	NI	PB	ZN	AL	CR	CD
C	26		869.	0.062	4.21	5.53	1.95	0.80	0.220	0.09	0.12	0.02	0.02	0.02	0.01	0.034	0.010	0.002	0.019	0.003	0.016	0.0005	0.0003
C	28		3529.	0.048	4.32	3.95	1.35	0.50	0.178	0.01	0.05	0.01	0.01	0.01	0.01	0.010	0.002	0.001	0.011	0.002	0.005	0.0005	0.0001
C	36	I	2755.	0.049	4.31	4.13	1.55	0.52	0.184	0.03	0.09	0.02	0.02	0.02	0.01	0.028	0.012	0.004	0.012	0.002	0.005	0.0005	0.0002
C	37		4437.	0.040	4.40	3.62	1.35	0.40	0.153	0.01	0.03	0.01	0.01	0.01	0.01	0.008	0.001	0.001	0.010	0.002	0.005	0.0005	0.0001

APPENDIX 3

Meteorological Summary

Appendix 3
Meteorological Summary

Event No.	Date of Event	Starting Time (LST)	Ending Time (LST)	Duration (Hours)	Precipitation Type*	Precipitation Amount (mm)	Front+	Surface Wind Direction (degrees)	Upper Wind Direction (degrees)	Plume Direction (degrees)	Sector Width (degrees)
1	27-28 Aug. 78	2400	0800	8	R	13	W	110-180	150-190	130-190	60
2-1	28-29 Aug. 78	0800	1400	6	TR			160-190	200-240	160-250	90
2-2	28-29 Aug. 78	1900	2100	2	RW	7	C	330-340	290-310	280-340	60
3	29-30 Aug. 78	1300	1400	1	TRW	5	C	290-330	270-280	280-340	60
4-1	02-03 Sept. 78	1500	1900	4	TRW			210-290	220-270		
4-2	02-03 Sept. 78	2200	2400	2	TRW	19	C	200-260	220-250	200-290	90
5-1	06-07 Sept. 78	1200	1700	5	RW			230-270	240-260		
5-2	06-07 Sept. 78	2000	2100	1	RW--			270-320	280-300	230-300	70
5-3	06-07 Sept. 78	0600	0700	1	RW-	7	W	360-030	340-350	340-60	80
6-1	09-10 Sept. 78	1800	1900	1	RW-			80-100	170-190		
6-2	09-10 Sept. 78	0100	0500	4	TRW	3	W	110-150	140-160	130-190	60
7-1	10-11 Sept. 78	0800	1100	3	R--			150-160	170-200		
7-2	10-11 Sept. 78	0400	0500	1	R	4	W	160-190	190-260	200-260	60

"*" R: rain RW: rain shower T: thunderstorm
+: heavy -: light —: very light
"+" W: warm front C: cold front

Event No.	Date of Event	Starting Time (LST)	Ending Time (LST)	Duration (Hours)	Precipitation Type*	Precipitation Amount (mm)	Front⁺	Surface Wind Direction (degrees)	Upper Wind Direction (degrees)	Plume Direction (degrees)	Sector Width (degrees)
8	11-12 Sept. 78	1900	2100	2	RW	2	C	270-030	340-350	270-350	80
9	14-15 Sept. 78	1300	2300	10	TRW	16	W	130-170	150-180	130-180	50
10	15-16 Sept. 78	1700	1900	2	RW—	5	C	240-260	250-270	250-300	50
11-1	09-10 June 79	0800	0000	16	RW—	10	W	50-130	40-80	50-180	130
11-2	09-10 June 79	0700	0800	1	RW			170-190	210-220		
12	21-22 June 79	2000	2300	3	RW	2	W	200-180	200-220	150-240	90
13	23-24 June 79	1300	1900	6	RW-	1	C	330-360	300-320	290-360	70
14	26-27 June 79	1600	0200	10	TRW-	13	W	180-360	160-230	220-330	110
15-1	30-31 June 79	0900	1200	3	R-	12	W	30-40	10-30	360-80	80
15-2	30-31 June 79	2100	0800	11	R+			50-70	10-50		
16-1	01-02 July 79	0800	2000	12	RW+	14	C	40-90	340-350	330-90	120
16-2	01-02 July 79	2200	2300	1	RW			20-360	330-340		

"*" R: rain, RW: rain shower, T: thunderstorm
+: heavy. -: light, —: very light
"+" W: warm front, C: cold front

Event No.	Date of Event	Starting Time (LST)	Ending Time (LST)	Duration (Hours)	Precipitation Type*	Precipitation Amount (mm)	Front+	Surface Wind Direction (degrees)	Upper Wind Direction (degrees)	Plume Direction (degrees)	Sector Width (degrees)
17	24-25 July 79	0400	0800	4	RW+	11	W	170-180	200-220	150-240	90
18	25-26 July 79	0800	0500	21	TRW+	17	C	180-240 360-30	200-230 330-350	150-240 360-80	90 80
19	28-29 July 79	1000	1100	1	RW	4	W	210-240	240-260	200-260	60
20	01-02 Aug. 79	0400	0800	4	RW	8	C	40-70	-	40-160	120
21	02-03 Aug. 79	0800	1500	7	RW	7	C	340-40	270-350	270-50	140
22	06-07 Aug. 79	0500	0800	3	TRW	13	C	190-210	180-210	150-210	60
23	09-10 Aug. 79	0300	0700	4	RW-	5	C	190-200	200-150	150-210	90
24	17-18 Aug. 79	1400	2100	7	RW-	9	W	210-180	200-230	160-230	70
25	20-21 Aug. 79	1300	2100	8	TRW	8	C	220-310	170-10	160-20	220
26	22-23 Aug. 79	0200	0700	5	R	9	W	100-150	150-200	100-200	100

"*" R: rain, RW: rain shower, T: thunderstorm
+: heavy, -: light, - -: very light
"+" W: warm front, C: cold front

Event No.	Date of Event	Starting Time (LST)	Ending Time (LST)	Duration (Hours)	Precipitation Type*	Precipitation Amount (mm)	Front+	Surface Wind Direction (degrees)	Upper Wind Direction (degrees)	Plume Direction (degrees)	Sector Width (degrees)
27-1	23-24 Aug. 79	2200	2400	2	TRW	14	W	120-140	130-180	70-180	110
27-2	23-24 Aug. 79	0500	0600	1	RW+			150-160	130-180		
28	27-28 Aug. 79	1600	2300	7	R-	6	C	260-40	220-340	150-80	290
29-1	29-30 Aug. 79	0800	1400	6	RW+	14	W	170-220	210-220	160-310	150
29-2	29-30 Aug. 79	0200	0400	2	RW-			180-210	-		
30	10-11 Sept. 79	0800	1100	3	RW	9	C	270-290	240-320	270-10	100
31	11-12 Oct. 79	2200	0800	10	R-	15	C	100-130	140-160	100-210	110

"*" R: rain, RW: rain shower, T: thunderstorm
+: heavy, -: light, —: very light
"+" W: warm front, C: cold front

APPENDIX 4

Stratified Precipitation Data

Concentration data are grouped according to sampling date and frontal passage. The symbol at the top left corner of each table corresponds to the parameter under consideration. W and C under the heading F (for fronts) designate warm and cold frontal passages. The event dates are given in column 2. BN and PN indicate the number of samples collected outside and inside the plume for each individual event. The rest of the data are given in three blocks, i.e. "BACK" for background, "PLUM" for plume sector and "EXSS" for additional concentration due to plume interaction with precipitation. In each block, "MEAN", "STDV", "COV" and "MN DPO" correspond to mean concentration, standard deviation, coefficient of variation and mean deposition. Statistics for the background and plume sector blocks are based on BN and PN data points. A "-9.00" corresponds to data not determined.

The EXSS concentration is NOT calculated by subtracting the overall mean background concentration from the overall mean plume sector concentration. Rather, for each individual event, the mean background concentration is subtracted from the concentration of each sample within the plume sector and these differences are then averaged to obtain the mean additional plume sector concentration for the particular event. Negative values of additional concentration were replaced by zeros during individual events.

It should be noted that the concentrations of NO_3 and NH_4 are reported as $N\text{-}NO_3$ and $N\text{-}NH_4$.

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HF
                              BACK                                          PLUM                                          EXSS
                           -------------------------------------         -------------------------------------         -------------------------------------
 F      DATE    BN   RN     MEAN     STDV       COV   MN DPO           MEAN     STDV       COV   MN DPO           MEAN     STDV       COV   MN DPO

 W     780827    5    0   0.0991   0.0540   0.5950   1.1026        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
 W     780902    4    1   0.0639   0.0120   0.1885   1.2853         0.0676  -9.0000  -9.0000   2.1777         0.0037  -9.0000  -9.0000   0.1200
 W     780906    2    3   0.0441   0.0300   0.6799   0.7762         0.0656   0.0146   0.2219   0.3705         0.0215   0.0146   0.6771   0.1016
 W     780909    2    1   0.0651   0.0126   0.1933   0.3348         0.1230  -9.0000  -9.0000   0.7150         0.0580  -9.0000  -9.0000   0.3369
 W     780910    4    3   0.0625   0.0283   0.4529   0.3459         0.1702   0.0230   0.1351   0.6711         0.1077   0.0230   0.2136   0.4267
 W     780914    7    0   0.1050   0.0209   0.1987   1.7223        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
 W     790609    8    1   0.0842   0.0211   0.2511   0.7497         0.0676  -9.0000  -9.0000   0.5587         0.0     -9.0000  -9.0000   0.0
 W     790621    6    2   0.0400   0.0138   0.3446   0.0941         0.0364   0.0062   0.1710   0.0582         0.0013   0.0013   1.0000   0.0026
 W     790626    3    4   0.0668   0.0057   0.0852   1.3979         0.0506   0.0133   0.2636   0.4716         0.0      0.0     -9.0000   0.0
 W     790630    6    1   0.1133   0.0344   0.3037   1.3581         0.1738  -9.0000  -9.0000   2.7292         0.0605  -9.0000  -9.0000   0.9495
 W     790724   10    4   0.0667   0.0105   0.1580   0.7237         0.0693   0.0134   0.1939   0.7155         0.0074   0.0084   1.1350   0.0543
 W     790728    2    0   0.0585   0.0060   0.1032   0.4580        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
 W     790817    5    2   0.1166   0.0207   0.1775   0.7685         0.1539   0.0280   0.1822   1.5678         0.0373   0.0280   0.7516   0.3573
 W     790822    7    1   0.0938   0.0061   0.0654   1.1224         0.0513  -9.0000  -9.0000   0.[illegible]75    0.0     -9.0000  -9.0000   0.0
 W     790823    5    3   0.0899   0.0223   0.2487   1.5120         0.1485   0.0340   0.2292   1.3899         0.0587   0.0340   0.5803   0.4541
 W     790829    8    5   0.0716   0.0147   0.2050   1.0038         0.0843   0.0113   0.1335   0.9586         0.0132   0.0106   0.8051   0.1262

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                MEAN      0.0776   0.0199   0.2657   0.9222         0.0971   0.0180   0.1913   0.9839         0.0284   0.0150   0.7375   0.2253
                STDV      0.0227   0.0132   0.1697   0.4547         0.0475   0.0088   0.0427   0.7457         0.0324   0.0116   0.2763   0.2653
                 COV      0.2921   0.6616   0.6390   0.4931         0.4895   0.4899   0.2233   0.7579         1.1414   0.7716   0.3747   1.1772
                  NN     16.0000  16.0000  16.0000  16.0000        13.0000   8.0000   8.0000  13.0000        13.0000   8.0000   7.0000  13.0000
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HF				HACK				PLUM				EXSS			
F	DATE	BN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	4	0.0437	0.0369	0.8449	0.1914	0.0489	0.0048	0.0975	0.3138	0.0053	0.0048	0.9078	0.0300
C	780829	5	3	0.0220	0.0094	0.4279	0.1835	0.0485	0.0304	0.6278	0.1460	0.0312	0.0243	0.7795	0.0973
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.0986	0.0172	0.1746	0.2610	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.0207	0.0007	0.0345	0.0264	0.0562	-9.0000	-9.0000	0.1255	0.0356	-9.0000	-9.0000	0.0794
C	790623	2	3	0.0086	0.0037	0.4305	0.0045	0.0290	0.0127	0.4389	0.0178	0.0204	0.0127	0.6235	0.0120
C	790701	3	1	0.0460	0.0097	0.2108	0.8228	0.0955	-9.0000	-9.0000	2.6267	0.0495	-9.0000	-9.0000	1.3613
C	790725	3	10	0.0337	0.0044	0.1301	0.6446	0.0770	0.0235	0.3047	1.4147	0.0433	0.0235	0.5414	0.8156
C	790801	2	6	0.0144	0.0020	0.1032	0.1824	0.0359	0.0110	0.3065	0.1942	0.0165	0.0110	0.6659	0.0888
C	790802	3	8	0.0355	0.0059	0.1663	0.1208	0.0293	0.0110	0.3742	0.2388	0.0030	0.0051	1.7345	0.0183
C	790806	5	2	0.0164	0.0094	0.5734	0.2335	0.0390	0.0186	0.4762	0.5101	0.0226	0.0186	0.8217	0.2851
C	790809	8	3	0.0257	0.0070	0.2735	0.1177	0.0233	0.0062	0.2673	0.0897	0.0013	0.0018	1.3954	0.0068
C	790820	2	5	0.0331	0.0015	0.0460	0.3130	0.1387	0.0384	0.2767	1.0712	0.1055	0.0384	0.3636	0.7714
C	790827	1	9	0.0257	-9.0000	-9.0000	0.0893	0.0542	0.0135	0.2496	0.3231	0.0285	0.0135	0.4746	0.1671
C	790910	7	3	0.0214	0.0091	0.4248	0.1715	0.0322	0.0078	0.2423	0.2621	0.0108	0.0078	0.7240	0.0862
C	791011	7	4	0.0533	0.0106	0.2008	0.8682	0.0568	0.0120	0.2107	0.8216	0.0068	0.0094	1.3771	0.0600
		MEAN		0.0239	0.0085	0.2974	0.2835	0.0575	0.0159	0.3113	0.5611	0.0272	0.0142	0.8674	0.2771
		STDV		0.0120	0.0088	0.2252	0.2730	0.0311	0.0094	0.1341	0.6704	0.0262	0.0100	0.4018	0.3950
		COV		0.4162	1.0404	0.7572	0.9628	0.5402	0.5892	0.4308	1.1948	0.9633	0.6999	0.4632	1.4253
		NN		14.0000	13.0000	13.0000	14.0000	15.0000	13.0000	13.0000	15.0000	14.0000	12.0000	12.0000	14.0000

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PH
                          HACK                                     PLUM                                   EXSS
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F     DATE   BN  PN    MEAN     STDV      COV   MN DPO       MEAN     STDV      COV   MN DPO       MEAN     STDV      COV   MN DPO

W   780827    5   0  4.0940   0.2938   0.0718 -9.0000    -9.0000  -9.0000  -9.0000  -9.0000    -9.0000  -9.0000  -9.0000  -9.0000
W   780902    4   1  4.2025   0.0831   0.0198 -9.0000     4.1700  -9.0000  -9.0000  -9.0000     0.0     -9.0000  -9.0000  -9.0000
W   780906    2   3  4.4900   0.3600   0.0802 -9.0000     4.1933   0.0946   0.0226 -9.0000     0.0      0.0     -9.0000  -9.0000
W   780909    2   1  4.1950   0.0850   0.0203 -9.0000     3.9100  -9.0000  -9.0000  -9.0000     0.0     -9.0000  -9.0000  -9.0000
W   780910    4   3  4.2600   0.2331   0.0547 -9.0000     3.7733   0.0618   0.0164 -9.0000     0.0      0.0     -9.0000  -9.0000
W   780914    7   0  3.9886   0.0961   0.0241 -9.0000    -9.0000  -9.0000  -9.0000  -9.0000    -9.0000  -9.0000  -9.0000  -9.0000
W   790609    8   1  4.0862   0.0960   0.0235 -9.0000     4.1700  -9.0000  -9.0000  -9.0000     0.0838  -9.0000  -9.0000  -9.0000
W   790621    6   2  4.4250   0.1580   0.0357 -9.0000     4.4450   0.0750   0.0169 -9.0000     0.0475   0.0475   1.0000  -9.0000
W   790625    3   4  4.1767   0.0369   0.0088 -9.0000     4.3125   0.1245   0.0289 -9.0000     0.1358   0.1246   0.9171  -9.0000
W   790630    6   1  3.9700   0.1536   0.0387 -9.0000     3.7600  -9.0000  -9.0000  -9.0000     0.0     -9.0000  -9.0000  -9.0000
W   790724   10   4  4.1820   0.0740   0.0177 -9.0000     4.1675   0.0865   0.0207 -9.0000     0.0315   0.0448   1.4214  -9.0000
W   790728    2   0  4.2350   0.0450   0.0106 -9.0000    -9.0000  -9.0000  -9.0000  -9.0000    -9.0000  -9.0000  -9.0000  -9.0000
W   790817    5   2  3.9400   0.0770   0.0195 -9.0000     3.8200   0.0800   0.0209 -9.0000     0.0      0.0     -9.0000  -9.0000
W   790822    7   1  4.0286   0.0284   0.0071 -9.0000     4.2900  -9.0000  -9.0000  -9.0000     0.2614  -9.0000  -9.0000  -9.0000
W   790823    5   3  4.0560   0.1322   0.0325 -9.0000     3.8400   0.1023   0.0266 -9.0000     0.0      0.0     -9.0000  -9.0000
W   790829    8   5  4.1550   0.0950   0.0229 -9.0000     4.0780   0.0590   0.0145 -9.0000     0.0010   0.0020   2.0000  -9.0000

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               MEAN      4.1559   0.1280   0.0305 -9.0000     4.0715   0.0855   0.0209 -9.0000     0.0432   0.0274   1.3346  -9.0000
               STDV      0.1477   0.0907   0.0208 -9.0000     0.2180   0.0203   0.0047 -9.0000     0.0749   0.0415   0.4291  -9.0000
               COV       0.0355   0.7086   0.6821 -9.0000     0.0535   0.2373   0.2248 -9.0000     1.7346   1.5180   0.3215  -9.0000
               NN       16.0000  16.0000  16.0000  0.0      13.0000   8.0000   8.0000  0.0      13.0000   8.0000   4.0000   0.0
    PH
                          BACK                                     PLUM                                    EXSS
                          ------------------------------           ------------------------------          ------------------------------
    F    DATE    BN   PN    MEAN     STDV      COV   MN DPO          MEAN     STDV      COV   MN DPO          MEAN     STDV      COV   MN DPO

    C   780828    3    4  4.5200   0.3692   0.0817 -9.0000         4.3125   0.0413   0.0096 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   780829    5    3  4.7080   0.2219   0.0471 -9.0000         4.4800   0.4433   0.0989 -9.0000         0.1307   0.1848   1.4142 -9.0000
    C   780911    0    3 -9.0000  -9.0000  -9.0000 -9.0000         4.0133   0.0793   0.0198 -9.0000        -9.0000  -9.0000  -9.0000 -9.0000
    C   780915    2    1  4.6850   0.0151   0.0032 -9.0000         4.2500  -9.0000  -9.0000 -9.0000         0.0     -9.0000  -9.0000 -9.0000
    C   790623    2    3  5.1100   0.2000   0.0391 -9.0000         4.5900   0.2276   0.0496 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790701    3    1  4.3467   0.0903   0.0208 -9.0000         4.0200  -9.0000  -9.0000 -9.0000         0.0     -9.0000  -9.0000 -9.0000
    C   790725    3   10  4.4767   0.0574   0.0128 -9.0000         4.1320   0.1248   0.0302 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790801    2    6  4.7150   0.0450   0.0096 -9.0000         4.4633   0.1241   0.0278 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790802    3    8  4.4567   0.0757   0.0170 -9.0000         4.5612   0.1537   0.0337 -9.0000         0.1375   0.1062   0.7723 -9.0000
    C   790806    5    2  4.8820   0.3206   0.0657 -9.0000         4.4650   0.2250   0.0504 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790809    8    3  4.6087   0.1303   0.0263 -9.0000         4.6500   0.1296   0.0279 -9.0000         0.0738   0.1043   1.4142 -9.0000
    C   790820    2    5  4.4800   0.0199   0.0044 -9.0000         3.8740   0.1167   0.0301 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790827    1    9  4.5900  -9.0000  -9.0000 -9.0000         4.2800   0.1121   0.0262 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   790910    7    3  4.8457   0.5841   0.1205 -9.0000         4.5067   0.1133   0.0251 -9.0000         0.0      0.0     -9.0000 -9.0000
    C   791011    7    4  4.2843   0.0873   0.0204 -9.0000         4.2550   0.0874   0.0205 -9.0000         0.0229   0.0269   1.1759 -9.0000

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                 MEAN     4.6220   0.1705   0.0362 -9.0000         4.3235   0.1522   0.0346 -9.0000         0.0261   0.0352   1.1942 -9.0000
                 STDV     0.2148   0.1607   0.0333 -9.0000         0.2268   0.0976   0.0214 -9.0000         0.0481   0.0593   0.2623 -9.0000
                 COV      0.0465   0.9426   0.9209 -9.0000         0.0525   0.6416   0.6182 -9.0000         1.8474   1.6851   0.2196 -9.0000
                 NN      14.0000  13.0000  13.0000  0.0           15.0000  13.0000  13.0000  0.0           14.0000  12.0000   4.0000  0.0
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ACID

F	DATE	BN	PN	BACK MEAN	BACK STDV	BACK COV	BACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	7.9160	1.4855	0.1877	103.1752	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	3.9775	0.9820	0.2469	83.1107	4.2400	-9.0000	-9.0000	136.5754	0.2625	-9.0000	-9.0000	8.4554
W	780906	2	3	4.9250	1.1450	0.2325	68.6693	5.0733	0.8654	0.1706	29.7028	0.4550	0.6435	1.4142	2.0799
W	780909	2	1	6.0100	0.2800	0.0466	29.6791	7.9800	-9.0000	-9.0000	46.3756	1.9700	-9.0000	-9.0000	11.4486
W	780910	4	3	5.1525	1.6061	0.3117	28.3879	11.6800	2.5734	0.2203	45.3254	6.5275	2.5734	0.3942	25.1804
W	780914	7	0	6.7557	0.6711	0.0993	108.6292	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	9.0175	1.0180	0.1129	81.6955	8.7000	-9.0000	-9.0000	71.8937	0.0	-9.0000	-9.0000	0.0
W	790621	4	0	5.0450	0.8812	0.1747	12.8582	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790626	3	4	5.8300	0.6656	0.1146	125.4560	8.2425	1.5574	0.1889	65.0894	2.4125	1.5573	0.6455	17.4909
W	790630	6	1	9.0483	1.5739	0.1739	115.5213	11.1300	-9.0000	-9.0000	174.7985	2.0817	-9.0000	-9.0000	32.6931
W	790724	10	4	5.8630	0.5099	0.1381	62.2862	6.0900	0.5571	0.0915	65.4509	0.3410	0.4408	1.2926	2.7984
W	790729	2	0	6.1550	0.6550	0.1064	68.2416	-9.0000	-9.0000	-9.0000	-9.0000	0000	-9.0000	-9.0000	-9.0000
W	790817	5	2	9.8760	1.1243	0.1138	66.2856	11.0500	1.2400	0.1122	113.3671	2070	1.2070	1.0000	11.2403
W	790822	7	0	6.2243	0.6395	0.1027	73.7516	-9.0000	-9.0000	-9.0000	-9.0000	000	-9.0000	-9.0000	-9.0000
W	790823	4	3	8.5225	1.1200	0.1314	133.2085	13.7667	2.4212	0.1759	132.2650	2442	2.4212	0.4617	43.5167
W	790829	8	5	5.7550	0.9822	0.1707	80.6014	6.1860	0.9281	0.1500	68.1568	6720	0.5523	0.8219	6.5641
		MEAN		6.6230	0.9776	0.1540	76.3472	8.5580	1.4489	0.1585	86.2727	1.9248	1.3422	0.8615	14.6789
		STDV		1.6722	0.3546	0.0647	34.1845	2.9024	0.7243	0.0412	43.7996	2.0380	0.8167	0.3659	13.1995
		COV		0.2522	0.3627	0.4200	0.4477	0.3391	0.4999	0.2602	0.5077	1.0588	0.6085	0.4247	0.8992
		NN		15.0000	16.0000	16.0000	16.0000	11.0000	7.0000	7.0000	11.0000	11.0000	7.0000	7.0000	11.0000

ACID

F	DATE	BW	PN	BACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	3	3.0100	0.7083	0.2353	16.9825	2.3367	1.4178	0.6068	19.4111	0.4367	0.6175	1.4142	3.5682
C	780829	5	1	2.3220	1.3985	0.6023	20.1380	5.2700	-9.0000	-9.0000	20.5422	2.9480	-9.0000	-9.0000	11.4911
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	6.9067	2.4111	0.3491	18.2091	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	0	0	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
C	790623	0	0	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
C	790701	3	1	4.7267	0.4623	0.0978	86.9027	6.2500	-9.0000	-9.0000	171.9082	1.5233	-9.0000	-9.0000	41.8997
C	790725	3	10	3.2133	0.3587	0.1116	65.4344	6.3800	1.2701	0.1991	119.1561	3.1667	1.2701	0.4011	61.9606
C	790801	2	4	2.6600	0.2300	0.0865	24.9129	3.6575	0.5855	0.1601	23.3178	0.9975	0.5855	0.5869	6.1908
C	790802	2	8	3.3100	0.1000	0.0302	13.1262	3.5337	0.8333	0.2358	29.2948	0.4513	0.6058	1.3425	2.9076
C	790806	4	2	2.6150	0.3398	0.1299	36.4621	3.6100	0.7100	0.1967	48.5912	0.9950	0.7100	0.7136	12.7021
C	790809	8	2	3.0375	0.4169	0.1373	14.2725	2.6950	0.1050	0.0390	14.1553	0.0	0.0	-9.0000	0.0
C	790820	2	3	3.4800	0.4200	0.1207	33.7018	8.2133	2.3634	0.2878	101.2133	4.7333	2.3634	0.4993	53.4651
C	790827	1	9	2.7500	-9.0000	-9.0000	9.5500	5.5067	1.1545	0.2097	32.5876	2.7567	1.1545	0.4188	15.8979
C	790910	6	3	2.9967	0.2939	0.0981	24.3262	3.6700	0.5593	0.1524	29.9552	0.7122	0.5044	0.7082	5.6548
C	791011	7	4	4.6500	0.8155	0.1754	75.4809	4.8950	0.8166	0.1668	72.6718	0.5250	0.5419	1.0322	6.1488
		MEAN		3.2309	0.5040	0.1659	35.1408	4.8403	1.1115	0.2366	53.9240	1.6038	0.8353	0.7908	18.4906
		STDV		0.7202	0.3419	0.1466	25.1727	1.6983	0.6940	0.1391	46.8446	1.3946	0.6081	0.3622	20.4651
		COV		0.2229	0.6784	0.8836	0.7163	0.3509	0.6243	0.5879	0.8687	0.8696	0.7280	0.4581	1.1068
		NN		12.0000	11.0000	11.0000	12.0000	13.0000	11.0000	11.0000	13.0000	12.0000	10.0000	9.0000	12.0000

SO4

F	DATE	BN	PN	BACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	3.9900	0.5142	0.1289	51.9257	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	3.4375	0.5628	0.1637	60.0779	3.8500	-9.0000	-9.0000	124.0131	0.4125	-9.0000	-9.0000	13.2871
W	780906	2	3	2.8500	0.3500	0.1228	31.4848	5.4500	1.0108	0.1855	31.5161	2.6000	1.0108	0.3888	14.1454
W	780909	2	1	5.8250	0.5250	0.0901	28.5453	9.1000	-9.0000	-9.0000	52.8845	3.2750	-9.0000	-9.0000	19.0326
W	780910	4	3	4.0625	1.1701	0.2880	22.0136	10.0500	0.2273	0.0226	39.0845	5.9875	0.2274	0.0380	23.2012
W	780914	7	0	4.2643	0.4549	0.1067	66.5502	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	2	7.0437	0.9036	0.1283	63.3373	8.4000	1.1500	0.1369	76.1490	1.3563	1.1500	0.8479	12.9749
W	790621	6	2	3.9083	0.5334	0.1365	8.7193	8.5000	1.9000	0.2235	12.2580	4.5917	1.9000	0.4138	6.2750
W	790626	3	4	5.3500	0.3895	0.0728	109.9255	8.6125	0.6339	0.0736	72.2197	3.2625	0.6338	0.1943	28.5401
W	790630	6	1	6.7917	1.6991	0.2502	83.4222	8.5500	-9.0000	-9.0000	134.2792	1.7583	-9.0000	-9.0000	27.6150
W	790724	11	4	3.6818	0.4002	0.1087	39.0554	4.3625	0.6484	0.1486	45.8005	0.6807	0.6484	0.9526	5.5054
W	790728	2	1	5.5000	0.0	0.0	40.8699	11.8000	-9.0000	-9.0000	24.5032	6.3000	-9.0000	-9.0000	13.0822
W	790817	5	2	5.4700	0.4906	0.0897	37.1106	7.0500	0.8500	0.1206	72.2664	1.5800	0.8500	0.5380	15.4925
W	790822	7	1	4.3500	0.7167	0.1647	51.7474	7.9000	-9.0000	-9.0000	62.7633	3.5500	-9.0000	-9.0000	28.2038
W	790823	5	3	5.8800	0.6831	0.1162	102.2696	9.8500	1.4301	0.1452	96.0564	3.9700	1.4300	0.3602	34.8256
W	790829	8	5	4.4875	0.7167	0.1597	63.2379	5.0400	1.1034	0.2189	53.7977	0.8100	0.7315	0.9030	7.5989
		MEAN		4.8058	0.6319	0.1329	53.7682	7.7511	0.9949	0.1417	64.1136	2.8667	0.9535	0.5152	17.8416
		STDV		1.1713	0.3710	0.0648	26.9353	2.2381	0.4601	0.0614	34.1482	1.8279	0.4652	0.3044	8.9167
		COV		0.2437	0.5871	0.4874	0.5010	0.2887	0.4625	0.4332	0.5326	0.6376	0.4878	0.5909	0.4998
		NN		16.0000	16.0000	16.0000	16.0000	14.0000	9.0000	9.0000	14.0000	14.0000	9.0000	9.0000	14.0000

SO4

F	DATE	BN	PN	BACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	4	2.0167	0.7771	0.3853	11.1351	2.2500	0.7425	0.3300	12.3080	0.4167	0.5947	1.4272	0.8254
C	780829	5	2	0.7900	0.3382	0.4281	6.8458	4.9250	0.4750	0.0964	13.4759	4.1350	0.4750	0.1149	11.2335
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	4.0000	0.2944	0.0736	10.6780	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.9750	0.3750	0.3846	1.2571	3.0000	-9.0000	-9.0000	6.6974	2.0250	-9.0000	-9.0000	4.5207
C	790623	3	3	0.5500	0.1780	0.3236	0.4132	2.3500	0.7483	0.3184	1.4688	1.8000	0.7483	0.4157	1.0985
C	790701	3	1	2.1500	0.0817	0.0380	39.3347	3.8000	-9.0000	-9.0000	104.5202	1.6500	-9.0000	-9.0000	45.3838
C	790725	3	10	1.8500	0.5657	0.3058	47.1298	4.1050	1.1354	0.2766	76.0176	2.2550	1.1354	0.5035	43.0887
C	790801	2	6	1.1500	0.1500	0.1304	10.1059	1.9333	0.5249	0.2715	9.9779	0.7833	0.5249	0.6701	3.7267
C	790802	4	8	1.2625	0.3228	0.2557	3.9076	2.0937	0.8549	0.4083	16.4088	0.9141	0.7290	0.7976	6.5988
C	790806	6	2	1.0167	0.1724	0.1696	13.9377	2.4250	0.3750	0.1546	32.7778	1.4083	0.3750	0.2663	18.8247
C	790809	8	3	1.0750	0.2062	0.1918	5.3482	1.5833	0.6637	0.4192	5.1115	0.5500	0.6255	1.1373	1.0622
C	790820	2	5	1.1250	0.0250	0.0222	10.3760	4.9900	2.2162	0.4441	44.6570	3.8650	2.2162	0.5734	34.4834
C	790827	1	9	2.1500	-9.0000	-9.0000	7.4663	4.8333	1.1198	0.2317	28.6676	2.6833	1.1198	0.4173	15.6193
C	790910	7	3	1.9929	0.1678	0.0842	15.5597	3.3833	0.5949	0.1758	27.5443	1.3905	0.5949	0.4278	11.1561
C	791011	7	4	1.6643	0.2215	0.1331	27.5383	2.5875	1.2386	0.4787	41.3112	0.9518	1.2155	1.2770	16.2708
		MEAN		1.4120	0.2755	0.2194	14.3111	3.2173	0.8449	0.2830	28.7747	1.7734	0.8629	0.6690	15.2780
		STDV		0.5214	0.1976	0.1321	13.5696	1.1189	0.4863	0.1275	27.7226	1.1053	0.4856	0.3949	14.7168
		COV		0.3695	0.7172	0.6019	0.9482	0.3478	0.5755	0.4506	0.9634	0.6232	0.5628	0.5903	0.9633
		NN		14.0000	13.0000	13.0000	14.0000	15.0000	13.0000	13.0000	15.0000	14.0000	12.0000	12.0000	14.0000

NO3

				HACK				PLUM				EXSS			
F	DATE	BN	RN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780427	5	0	0.4000	0.1068	0.2669	5.2212	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.3475	0.0750	0.2157	5.4883	0.3000	-9.0000	-9.0000	9.6634	0.0	-9.0000	-9.0000	0.0
W	780906	2	3	0.4450	0.1050	0.2360	4.5057	0.5333	0.1184	0.2220	3.6214	0.1067	0.0972	0.9108	0.9650
W	780909	2	1	0.6750	0.0950	0.1407	3.4431	0.6200	-9.0000	-9.0000	3.6031	0.0	-9.0000	-9.0000	0.0
W	780910	4	3	0.5625	0.1535	0.2729	3.0141	1.0867	0.0838	0.0771	4.3218	0.5242	0.0838	0.1599	2.1225
W	780914	7	0	0.4071	0.0845	0.2075	6.4367	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.9650	0.2962	0.3070	7.9518	0.6800	-9.0000	-9.0000	5.6193	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.5867	0.0730	0.1244	1.3169	0.7900	0.1800	0.2278	1.1379	0.2033	0.1800	0.8852	0.2398
W	790626	3	3	0.8067	0.1482	0.1837	16.0948	1.5333	0.1239	0.0808	10.3351	0.7267	0.1239	0.1705	5.1270
W	790630	6	1	0.4467	0.1363	0.3052	5.1564	0.4900	-9.0000	-9.0000	7.6955	0.0433	-9.0000	-9.0000	0.6806
W	790724	10	4	0.4650	0.1409	0.3030	4.7733	0.4425	0.1907	0.4310	4.3708	0.0763	0.1321	1.7321	0.4934
W	790728	2	1	0.6200	0.1800	0.2903	3.9189	1.2000	-9.0000	-9.0000	2.4918	0.5800	-9.0000	-9.0000	1.2044
W	790817	5	2	1.2660	0.1622	0.1281	8.5018	1.0200	0.1800	0.1765	10.3947	0.0	0.0	-9.0000	0.0
W	790822	7	0	0.4800	0.1838	0.3830	5.2339	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	3	0.7250	0.1344	0.1854	11.5066	1.0900	0.3662	0.3359	9.6878	0.3733	0.3574	0.9572	2.2712
W	790829	8	5	0.5037	0.1251	0.2483	6.8803	0.5200	0.2088	0.4015	5.6410	0.1065	0.1329	1.2476	1.1281
	MEAN			0.6064	0.1375	0.2374	6.2152	0.7928	0.1815	0.2481	6.0449	0.2108	0.1384	0.8662	1.0948
	STDV			0.2335	0.0530	0.0712	3.4473	0.3489	0.0804	0.1265	3.0517	0.2438	0.0960	0.5194	1.3808
	COV			0.3851	0.3857	0.2998	0.5546	0.4401	0.4433	0.5182	0.5048	1.1566	0.6940	0.5997	1.2613
	NN			16.0000	16.0000	16.0000	16.0000	13.0000	8.0000	8.0000	13.0000	13.0000	8.0000	7.0000	13.0000

NO3

F	DATE	BN	PN	HACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	4	0.1533	0.0618	0.4032	0.7933	0.1650	0.0357	0.2164	0.9644	0.0200	0.0271	1.3540	0.0440
C	780829	5	2	0.0780	0.0306	0.3922	0.6179	0.1250	0.0650	0.5200	0.2859	0.0560	0.0560	1.0000	0.0996
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.5467	0.0525	0.0960	1.4758	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.2400	0.0400	0.1667	0.3076	0.3400	-9.0000	-9.0000	0.7590	0.1000	-9.0000	-9.0000	0.2232
C	790623	2	3	0.0750	0.0450	0.6000	0.0368	0.0900	0.0082	0.0907	0.0613	0.0150	0.0082	0.5443	0.0108
C	790701	3	1	0.2400	0.0455	0.1896	4.4044	0.1700	-9.0000	-9.0000	4.6759	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.1567	0.0655	0.4180	4.1769	0.3250	0.0970	0.2984	5.9718	0.1730	0.0871	0.5037	3.2536
C	790801	2	5	0.1600	0.0700	0.4375	1.2751	0.2500	0.1302	0.5209	1.0274	0.0980	0.1230	1.2554	0.2328
C	790802	3	8	0.2067	0.0602	0.2912	0.6107	0.0950	0.0287	0.3023	0.7661	0.0	0.0	-9.0000	0.0
C	790806	4	2	0.1675	0.0286	0.1708	2.2683	0.1200	0.0900	0.7500	1.5260	0.0213	0.0213	1.0000	0.2631
C	790809	8	2	0.1712	0.0276	0.1611	0.7694	0.1450	0.0250	0.1724	0.7620	0.0	0.0	-9.0000	0.0
C	790820	2	5	0.0750	0.0050	0.0667	0.6810	0.4180	0.3819	0.9137	1.7914	0.3430	0.3819	1.1134	1.1131
C	790827	1	9	0.2100	-9.0000	-9.0000	0.7293	0.3789	0.0681	0.1796	2.2042	0.1689	0.0681	0.4030	0.9297
C	790910	6	3	0.3150	0.0685	0.2174	2.6941	0.3300	0.0294	0.0892	2.7039	0.0233	0.0184	0.7890	0.1869
C	791011	7	4	0.6857	0.1822	0.2657	10.6766	0.5900	0.2228	0.3777	8.0288	0.0711	0.1231	1.7320	0.4825
	MEAN			0.2096	0.0562	0.2908	2.1458	0.2726	0.0950	0.3483	2.2002	0.0778	0.0762	0.9695	0.4885
	STDV			0.1476	0.0409	0.1440	2.7186	0.1566	0.0992	0.2511	2.2071	0.0929	0.1014	0.3981	0.8367
	COV			0.7041	0.7273	0.4951	1.2669	0.5744	1.0449	0.7210	1.0031	1.1932	1.3315	0.4106	1.7127
	NN			14.0000	13.0000	13.0000	14.0000	15.0000	13.0000	13.0000	15.0000	14.0000	12.0000	10.0000	14.0000

NH4

F	DATE	BN	PN	BACK MEAN	BACK STDV	BACK COV	BACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	0.2872	0.0437	0.1522	3.7636	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.4050	0.0569	0.1404	6.9312	0.3900	-9.0000	-9.0000	12.5624	0.0	-9.0000	-9.0000	0.0
W	780906	2	3	0.8050	0.0950	0.1180	8.9245	0.9100	0.1219	0.1340	5.8562	0.1267	0.0919	0.7252	1.0158
W	780909	2	1	1.1800	0.1600	0.1356	5.7360	1.1900	-9.0000	-9.0000	6.9157	0.0100	-9.0000	-9.0000	0.0581
W	780910	4	3	0.7050	0.2594	0.3679	3.8468	1.5033	0.2081	0.1384	6.0063	0.7983	0.2081	0.2606	3.2499
W	780914	7	0	0.2526	0.1373	0.5438	3.7861	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.9681	0.1849	0.1910	8.5649	0.7100	-9.0000	-9.0000	5.8672	0.0	-9.0000	-9.0000	0.0
W	790621	5	2	0.5820	0.1786	0.3069	1.3490	1.5750	0.9250	0.5873	2.0439	0.9930	0.9250	0.9315	1.1530
W	790626	3	4	0.6000	0.0163	0.0327	10.3878	0.8575	0.1424	0.1660	7.0569	0.3575	0.1424	0.3982	2.8746
W	790630	6	1	0.5817	0.1194	0.2052	7.5507	0.5300	-9.0000	-9.0000	8.3237	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.4130	0.1158	0.2805	4.4425	0.4275	0.1108	0.2591	4.4330	0.0510	0.0736	1.4427	0.3857
W	790728	2	1	0.7050	0.0250	0.0355	5.1432	0.6400	-9.0000	-9.0000	1.3290	0.0	-9.0000	-9.0000	0.0
W	790817	5	2	0.9720	0.7655	0.7876	7.3648	0.5400	0.1400	0.2593	5.4554	0.0	0.0	-9.0000	0.0
W	790822	7	0	0.1843	0.0306	0.1663	2.2052	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	3	0.6000	0.1347	0.2245	9.5418	0.6867	0.1678	0.2444	6.3782	0.1233	0.1281	1.0390	0.7159
W	790829	8	5	0.5675	0.2732	0.4814	8.0938	0.5400	0.2504	0.4638	5.6711	0.1090	0.1359	1.2465	1.0002
	MEAN			0.6068	0.1623	0.2606	6.1020	0.8077	0.2583	0.2815	5.9922	0.1976	0.2131	0.8634	0.8118
	STDV			0.2681	0.1730	0.1942	2.6230	0.3745	0.2557	0.1519	2.6447	0.3149	0.2749	0.3994	1.0695
	COV			0.4418	1.0662	0.7454	0.4299	0.4637	0.9900	0.5397	0.4414	1.5938	1.2900	0.4626	1.3174
	NN			16.0000	16.0000	16.0000	16.0000	13.0000	8.0000	8.0000	13.0000	13.0000	8.0000	7.0000	13.0000

NH4

F	DATE	HN	PN	BACK MEAN	 STDV	 COV	 MN DPO	PLUM MEAN	 STDV	 COV	 MN DPO	EXSS MEAN	 STDV	 COV	 MN DPO
C	780828	3	3	0.4733	0.2654	0.5606	3.2288	0.2020	0.0457	0.2264	1.6607	0.0	0.0	-9.0000	0.0
C	780829	5	2	0.1020	0.0350	0.3434	0.8386	0.2740	0.0500	0.1825	0.8671	0.1720	0.0500	0.2907	0.5328
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.7333	0.1112	0.1516	1.9662	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.4250	0.1250	0.2941	0.5466	0.3600	-9.0000	-9.0000	0.8037	0.0	-9.0000	-9.0000	0.0
C	790623	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.1200	0.0700	0.5833	0.1057	-9.0000	-9.0000	-9.0000	-9.0000
C	790701	3	1	0.2267	0.0330	0.1456	4.1863	0.2100	-9.0000	-9.0000	5.7761	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.1633	0.0685	0.4192	4.5313	0.3270	0.1178	0.3603	6.0423	0.1660	0.1143	0.6884	3.1703
C	790801	2	5	0.1500	0.0500	0.3333	1.2371	0.2400	0.2736	1.1402	0.6317	0.1400	0.2420	1.7285	0.1830
C	790802	3	8	0.3167	0.2811	0.8877	1.0648	0.1787	0.1361	0.7617	1.4672	0.0179	0.0474	2.6458	0.1507
C	790806	4	2	0.3075	0.2058	0.6694	4.0319	0.1350	0.1250	0.9259	1.6849	0.0	0.0	-9.0000	0.0
C	790809	8	2	0.1187	0.0302	0.2542	0.5147	0.1150	0.0450	0.3913	0.6030	0.0206	0.0206	1.0000	0.1079
C	790820	2	4	0.1750	0.0150	0.0857	1.5782	0.3725	0.2103	0.5645	2.1939	0.2087	0.1978	0.9478	0.6594
C	790827	1	9	0.2300	-9.0000	-9.0000	0.7987	0.5289	0.1254	0.2371	3.0845	0.2989	0.1254	0.4195	1.6887
C	790910	6	3	0.3600	0.0480	0.1332	2.8337	0.6867	0.1367	0.1991	5.5918	0.3267	0.1367	0.4185	2.6313
C	791011	7	4	0.2154	0.0408	0.1895	3.5102	0.3537	0.2191	0.6194	5.7506	0.1462	0.2134	1.4598	2.5906
	MEAN			0.2511	0.0998	0.3597	2.2231	0.3225	0.1282	0.4879	2.5486	0.1152	0.1043	1.0665	0.9011
	STDV			0.1126	0.0924	0.2303	1.4650	0.1871	0.0679	0.3002	2.0800	0.1130	0.0832	0.7218	1.1357
	COV			0.4484	0.9259	0.6402	0.6590	0.5802	0.5298	0.6152	0.8161	0.9815	0.7975	0.6768	1.2603
	NN			13.0000	12.0000	12.0000	13.0000	15.0000	13.0000	13.0000	15.0000	13.0000	11.0000	9.0000	13.0000

CL F	DATE	BN	PN	BACK MEAN	BACK STDV	BACK COV	BACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	0.1220	0.0248	0.2034	1.5771	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0575	0.0130	0.2259	0.9460	0.0500	-9.0000	-9.0000	1.6106	0.0	-9.0000	-9.0000	0.0
W	780906	2	3	0.1050	0.0050	0.0476	1.2243	0.1600	0.1042	0.5791	1.4374	0.0867	0.0926	1.0683	0.8330
W	780909	2	1	0.1450	0.0450	0.3103	0.6828	0.1500	-9.0000	-9.0000	0.8717	0.0050	-9.0000	-9.0000	0.0291
W	780910	4	3	0.1075	0.0512	0.4760	0.5816	0.2300	0.0294	0.1280	0.8897	0.1225	0.0294	0.2403	0.4694
W	780914	7	0	0.1156	0.0461	0.3889	1.9008	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.2275	0.0638	0.2804	1.9939	0.2000	-9.0000	-9.0000	1.6527	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.3600	0.2335	0.6485	0.8900	0.2300	0.0600	0.2609	0.3283	0.0	0.0	-9.0000	0.0
W	790626	3	3	0.1700	0.0356	0.2094	3.4204	0.2967	0.0403	0.1358	2.7907	0.1267	0.0403	0.3180	1.1546
W	790630	6	1	0.1933	0.1435	0.7422	1.9281	0.1200	-9.0000	-9.0000	1.8846	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.1546	0.0949	0.5949	1.7230	0.1225	0.0517	0.4217	1.2194	0.0126	0.0218	1.7320	0.0815
W	790729	2	1	0.2150	0.0550	0.2558	1.8079	0.2400	-9.0000	-9.0000	0.4984	0.0250	-9.0000	-9.0000	0.0519
W	790817	5	2	0.5300	0.5067	0.9561	4.0628	0.2100	0.0200	0.0952	2.1583	0.0	0.0	-9.0000	0.0
W	790822	7	0	0.2985	0.1605	0.5375	3.6989	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	3	0.2375	0.2731	0.9179	4.8743	0.2333	0.0618	0.2650	2.1639	0.0075	0.0106	1.4142	0.0352
W	790829	8	5	0.1650	0.0819	0.4961	2.2439	0.1192	0.0660	0.5541	1.0746	0.0100	0.0138	1.3784	0.0797
		MEAN		0.2045	0.1146	0.4557	2.0972	0.1832	0.0542	0.3050	1.4292	0.0305	0.0261	1.0252	0.2103
		STDV		0.1151	0.1259	0.2563	1.2331	0.0648	0.0243	0.1797	0.6831	0.0460	0.0283	0.5618	0.3605
		COV		0.5626	1.0989	0.5625	0.5880	0.3538	0.4482	0.5892	0.4779	1.5093	1.0856	0.5480	1.7142
		NN		16.0000	16.0000	16.0000	16.0000	13.0000	8.0000	8.0000	13.0000	13.0000	8.0000	6.0000	13.0000

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 CL
                               HACK                                  PLUM                                   EXSS
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 F     DATE   BN  PN   MEAN     STDV      COV   MN DPO       MEAN     STDV      COV   MN DPO       MEAN     STDV      COV   MN DPO

 C    780828   3   3  0.1000   0.0455   0.4546  0.6472      0.0567   0.0125   0.2201  0.4631      0.0      0.0     -9.0000  0.0
 C    780829   5   2  0.1580   0.1477   0.9348  0.8198      0.1900   0.1100   0.5789  0.4227      0.0710   0.0710   1.0000  0.1263
 C    780911   0   3 -9.0000  -9.0000  -9.0000 -9.0000      0.1900   0.1061   0.5587  0.5058     -9.0000  -9.0000  -9.0000 -9.0000
 C    780915   0   0 -9.0000  -9.0000  -9.0000 -9.0000     -9.0000  -9.0000  -9.0000 -9.0000     -9.0000  -9.0000  -9.0000 -9.0000
 C    790623   2   3  0.1800   0.0300   0.1667  0.1038      0.1667   0.0492   0.2953  0.1225      0.0167   0.0236   1.4142  0.0157
 C    790701   3   1  0.1300   0.0141   0.1088  2.4035      0.0600  -9.0000  -9.0000  1.6503      0.0     -9.0000  -9.0000  0.0
 C    790725   3  10  0.2367   0.2781   1.1752 10.2305      0.1030   0.0759   0.7369  2.0646      0.0053   0.0160   3.0000  0.1213
 C    790801   2   5  0.0700   0.0400   0.5714  0.5329      0.1020   0.0700   0.6860  0.5528      0.0380   0.0662   1.7408  0.2267
 C    790802   3   8  0.2267   0.2007   0.8855  0.5327      0.1587   0.1482   0.9335  1.0817      0.0379   0.1003   2.6458  0.1704
 C    790806   4   2  0.0625   0.0083   0.1327  0.9182      0.0750   0.0250   0.3333  0.9957      0.0188   0.0188   1.0000  0.2321
 C    790809   8   3  0.0900   0.0532   0.5906  0.3867      0.2133   0.1929   0.9044  0.5050      0.1433   0.1752   1.2222  0.2531
 C    790820   2   5  0.2100   0.1200   0.5714  2.3393      0.2740   0.1941   0.7083  1.1804      0.1060   0.1627   1.5347  0.1995
 C    790827   1   9  0.3600  -9.0000  -9.0000  1.2502      0.1733   0.0690   0.3979  0.9872      0.0      0.0     -9.0000  0.0
 C    790910   6   3  0.0917   0.0561   0.6120  0.7247      0.0733   0.0170   0.2318  0.5953      0.0      0.0     -9.0000  0.0
 C    791011   7   4  0.0986   0.0930   0.9430  1.2949      0.0725   0.0334   0.4613  1.0023      0.0032   0.0048   1.4866  0.0493

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                MEAN  0.1549   0.0905   0.5956  1.7065      0.1363   0.0849   0.5420  0.8664      0.0339   0.0532   1.6716  0.1073
                STDV  0.0824   0.0790   0.3307  2.5492      0.0653   0.0599   0.2327  0.5064      0.0443   0.0605   0.6618  0.0969
                COV   0.5321   0.8725   0.5553  1.4938      0.4790   0.7055   0.4294  0.5845      1.3070   1.1363   0.3959  0.9029
                NN   13.0000  12.0000  12.0000 13.0000     14.0000  13.0000  13.0000 14.0000     13.0000  12.0000   9.0000 13.0000
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CA
                          HACK                                      PLUM                                       EXSS
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F    DATE   BN  PN     MEAN     STDV      COV  MN DPO           MEAN     STDV      COV  MN DPO           MEAN     STDV      COV  MN DPO

W  780827    5   0  0.4040   0.3560   0.8811   4.0844        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
W  780902    4   1  0.4300   0.0696   0.1620   8.1155         0.5800  -9.0000  -9.0000  18.6825         0.1500  -9.0000  -9.0000   4.8317
W  780906    2   3  0.5500   0.1700   0.3091   5.2410         0.6767   0.2457   0.3631   4.9064         0.1800   0.1883   1.0463   1.7167
W  780909    2   1  0.6800   0.0500   0.0735   3.3421         0.8000  -9.0000  -9.0000   4.6492         0.1200  -9.0000  -9.0000   0.6974
W  780910    4   2  0.5425   0.0517   0.0952   2.8369         1.2600   0.1000   0.0794   5.3749         0.7175   0.1000   0.1394   3.1065
W  780914    7   0  0.1929   0.1123   0.5825   2.7945        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
W  790609    8   1  0.2900   0.1313   0.4529   2.3163         0.1300  -9.0000  -9.0000   1.0743         0.0     -9.0000  -9.0000   0.0
W  790621    5   2  0.6400   0.2733   0.4271   1.4668         0.8100   0.0900   0.1111   1.2043         0.1700   0.0900   0.5294   0.2245
W  790626    3   2  1.0533   0.2917   0.2769  20.4352         1.7150   0.0350   0.0204  13.1990         0.6617   0.0350   0.0529   4.9911
W  790630    6   1  0.1250   0.0310   0.2477   1.6751         0.0400  -9.0000  -9.0000   0.6282         0.0     -9.0000  -9.0000   0.0
W  790724   10   3  0.2580   0.1163   0.4506   2.2451         0.2067   0.0655   0.3169   2.6182         0.0107   0.0151   1.4142   0.1570
W  790728    2   0  0.5850   0.3950   0.6752   2.8368        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
W  790817    5   2  0.4620   0.0852   0.1844   3.0295         0.3600   0.1000   0.2778   3.6298         0.0      0.0     -9.0000   0.0
W  790822    7   0  0.4529   0.2211   0.4882   4.7364        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
W  790823    4   3  0.3525   0.2091   0.5932   5.2524         0.2167   0.0881   0.4065   1.8764         0.0      0.0     -9.0000   0.0
W  790829    8   5  0.2337   0.0812   0.3475   3.4294         0.2140   0.1131   0.5283   2.5150         0.0465   0.0573   1.2323   0.4783

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              MEAN  0.4532   0.1653   0.3904   4.6148         0.5841   0.1047   0.2629   5.0298         0.1714   0.0607   0.7357   1.3503
              STDV  0.2212   0.1104   0.2154   4.3893         0.4838   0.0580   0.1657   5.2210         0.2416   0.0600   0.5272   1.8204
               COV  0.4880   0.6680   0.5516   0.9511         0.8283   0.5538   0.6304   1.0380         1.4102   0.9885   0.7166   1.3482
                NN 16.0000  16.0000  16.0000  15.0000        12.0000   8.0000   8.0000  12.0000        12.0000   8.0000   6.0000  12.0000
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CA

F	DATE	BN	PN	HACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	3	0.3500	0.3544	1.0126	1.5000	0.1533	0.0519	0.3382	1.2794	0.0	0.0	-9.0000	0.0
C	780829	5	2	0.2060	0.0637	0.3095	1.6570	0.3050	0.0750	0.2459	1.0462	0.0990	0.0750	0.7576	0.3710
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.2333	0.1190	0.5099	0.6176	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.3200	0.1900	0.5937	0.4015	0.4500	-9.0000	-9.0000	1.0046	0.1300	-9.0000	-9.0000	0.2902
C	790623	2	2	0.2100	0.0100	0.0476	0.1300	0.1400	0.0300	0.2143	0.1156	0.0	0.0	-9.0000	0.0
C	790701	3	1	0.0633	0.0205	0.3244	1.2098	0.0400	-9.0000	-9.0000	1.1002	0.0	-9.0000	-9.0000	0.0
C	790725	3	9	0.0733	0.0826	1.1263	3.1004	0.0533	0.0302	0.5660	1.0287	0.0063	0.0178	2.8284	0.1487
C	790801	2	4	0.1250	0.0650	0.5200	0.9687	0.1550	0.0320	0.2066	0.9866	0.0338	0.0270	0.8004	0.2100
C	790802	2	8	0.1150	0.0650	0.5652	0.4351	0.1987	0.3124	1.5720	2.7025	0.1175	0.2979	2.5350	1.9735
C	790806	4	2	0.1875	0.0497	0.2650	2.4162	0.3000	0.0300	0.1000	4.1576	0.1125	0.0300	0.2667	1.5843
C	790809	8	2	0.1062	0.0522	0.4912	0.4512	0.1100	0.0100	0.0909	0.5775	0.0069	0.0069	1.0000	0.0360
C	790820	2	3	0.0450	0.0050	0.1111	0.4021	0.2267	0.1586	0.6997	1.2954	0.1817	0.1586	0.8731	0.6956
C	790827	1	9	0.3000	-9.0000	-9.0000	1.0418	0.3200	0.0629	0.1965	1.9002	0.0367	0.0414	1.1282	0.2126
C	790910	6	3	0.2483	0.0944	0.3802	2.3052	0.2067	0.0236	0.1140	1.6900	0.0	0.0	-9.0000	0.0
C	791011	7	4	0.1529	0.1325	0.8670	2.4590	0.1250	0.0550	0.4400	1.6459	0.0168	0.0291	1.7320	0.1140
	MEAN			0.1788	0.0912	0.5088	1.3198	0.2011	0.0762	0.4072	1.4099	0.0529	0.0570	1.3246	0.4026
	STDV			0.0945	0.0900	0.3156	0.9118	0.1060	0.0790	0.3835	0.9430	0.0596	0.0842	0.8135	0.5957
	COV			0.5303	0.9669	0.6203	0.6908	0.5268	1.0368	0.9418	0.6688	1.1267	1.4784	0.6142	1.4797
	NN			14.0000	13.0000	13.0000	14.0000	15.0000	13.0000	13.0000	15.0000	14.0000	12.0000	9.0000	14.0000

MG

				BACK				PLUM				EXSS			
F	DATE	HN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	0.0160	0.0080	0.5000	0.2279	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0550	0.0050	0.0909	1.0337	0.0900	-9.0000	-9.0000	2.8990	0.0350	-9.0000	-9.0000	1.1274
W	780906	2	3	0.0850	0.0350	0.4118	0.7388	0.1133	0.0330	0.2912	0.7873	0.0333	0.0266	0.7969	0.2844
W	780909	2	1	0.1100	0.0100	0.0909	0.5563	0.1100	-9.0000	-9.0000	0.6393	0.0	-9.0000	-9.0000	0.0
W	780910	4	2	0.0750	0.0335	0.4472	0.4479	0.1650	0.0050	0.0303	0.6846	0.0900	0.0050	0.0556	0.3710
W	780914	7	0	0.0300	0.0200	0.6667	0.4603	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.0525	0.0192	0.3658	0.4287	0.0400	-9.0000	-9.0000	0.3305	0.0	-9.0000	-9.0000	0.0
W	790621	5	2	0.1060	0.0377	0.3560	0.2623	0.1700	0.0500	0.2941	0.2404	0.0640	0.0500	0.7812	0.0781
W	790626	3	0	0.2300	0.0638	0.2773	4.4694	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790630	5	1	0.0220	0.0075	0.3402	0.2123	0.0100	-9.0000	-9.0000	0.1571	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0460	0.0196	0.4260	0.3970	0.0600	0.0644	1.0737	0.6172	0.0310	0.0537	1.7320	0.2876
W	790728	2	1	0.0450	0.0350	0.7778	0.2006	0.0100	-9.0000	-9.0000	0.0208	0.0	-9.0000	-9.0000	0.0
W	790817	4	2	0.0700	0.0141	0.2020	0.4202	0.0550	0.0250	0.4545	0.5442	0.0050	0.0050	1.0000	0.0466
W	790822	7	0	0.0729	0.0249	0.3419	0.7972	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	2	0.0250	0.0112	0.4472	0.3569	0.0200	0.0	0.0	0.2655	0.0	0.0	-9.0000	0.0
W	790829	6	5	0.0287	0.0215	0.7468	0.3407	0.0260	0.0162	0.6249	0.2601	0.0065	0.0086	1.3178	0.0547
		MEAN		0.0659	0.0229	0.4055	0.7094	0.0724	0.0277	0.3955	0.6205	0.0221	0.0213	0.9473	0.1875
		STDV		0.0505	0.0148	0.1943	0.9957	0.0545	0.0217	0.3437	0.7239	0.0285	0.0209	0.5166	0.3111
		COV		0.7564	0.6462	0.4792	1.4036	0.7528	0.7842	0.8690	1.1667	1.2893	0.9815	0.5454	1.6596
		NN		16.0000	16.0000	16.0000	16.0000	12.0000	7.0000	7.0000	12.0000	12.0000	7.0000	6.0000	12.0000

MG				BACK				PLUM				EXSS			
F	DATE	BN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	3	0.0333	0.0125	0.3742	0.1797	0.0167	0.0094	0.5657	0.1339	0.0	0.0	-9.0000	0.0
C	780829	5	2	0.0300	0.0167	0.5578	0.2369	0.0500	0.0300	0.6000	0.1825	0.0250	0.0250	1.0000	0.0974
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.0367	0.0125	0.3402	0.0964	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.0500	0.0100	0.2000	0.0634	0.1300	-9.0000	-9.0000	0.2902	0.0800	-9.0000	-9.0000	0.1786
C	790623	2	3	0.0400	0.0000	0.0007	0.0244	0.0267	0.0047	0.1768	0.0180	0.0	0.0	-9.0000	0.0
C	790701	3	1	0.0133	0.0047	0.3536	0.2499	0.0100	-9.0000	-9.0000	0.2751	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0267	0.0125	0.4677	0.5778	0.0260	0.0120	0.4615	0.4749	0.0047	0.0073	1.5714	0.0871
C	790801	2	4	0.1900	0.1600	0.8421	1.3094	0.0625	0.0390	0.6235	0.3941	0.0	0.0	-9.0000	0.0
C	790802	3	8	0.0167	0.0094	0.5657	0.0448	0.0387	0.0293	0.7572	0.3050	0.0246	0.0270	1.0973	0.1824
C	790806	4	2	0.0300	0.0122	0.4082	0.4955	0.0750	0.0550	0.7333	1.1032	0.0500	0.0500	1.0000	0.7534
C	790809	8	3	0.0787	0.1204	1.5283	0.4287	0.0167	0.0047	0.2828	0.0618	0.0	0.0	-9.0000	0.0
C	790820	2	5	0.0100	0.0	0.0	0.0929	0.0340	0.0185	0.5455	0.1551	0.0240	0.0185	0.7728	0.0646
C	790827	1	9	0.0600	-9.0000	-9.0000	0.2084	0.0478	0.0147	0.3085	0.2951	0.0022	0.0063	2.8284	0.0129
C	790910	6	3	0.0283	0.0146	0.5162	0.2741	0.0200	0.0	0.0	0.1645	0.0	0.0	-9.0000	0.0
C	791011	7	4	0.0271	0.0225	0.8288	0.4569	0.0275	0.0083	0.3015	0.4186	0.0039	0.0053	1.3453	0.0653
		MEAN		0.0453	0.0304	0.5110	0.3316	0.0412	0.0183	0.4382	0.2912	0.0153	0.0116	1.3736	0.1030
		STDV		0.0439	0.0478	0.3848	0.3198	0.0294	0.0152	0.2161	0.2525	0.0231	0.0150	0.6406	0.1908
		COV		0.9692	1.5714	0.7530	0.9642	0.7126	0.8293	0.4932	0.8672	1.5077	1.2905	0.4664	1.8532
		NN		14.0000	13.0000	13.0000	14.0000	15.0000	13.0000	13.0000	15.0000	14.0000	12.0000	7.0000	14.0000

NA				HACK				PLUM				EXSS			
F	DATE	BN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	0.0500	0.0126	0.2530	0.7168	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0650	0.0150	0.2308	1.1810	0.1100	-9.0000	-9.0000	3.5432	0.0450	-9.0000	-9.0000	1.4495
W	780905	2	3	0.0900	0.0400	0.4444	0.7583	0.1100	0.0374	0.3402	0.7923	0.0267	0.0309	1.1592	0.2641
W	780909	2	1	0.0900	0.0200	0.2222	0.4307	0.1200	-9.0000	-9.0000	0.6974	0.0300	-9.0000	-9.0000	0.1743
W	780910	4	2	0.1150	0.0541	0.4703	0.6759	0.1500	0.0100	0.0667	0.6166	0.0350	0.0100	0.2857	0.1357
W	780914	7	4	0.1071	0.0919	0.8579	1.6411	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	7	1	0.0871	0.0449	0.5158	0.7371	0.0600	-9.0000	-9.0000	0.4958	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.1633	0.1069	0.6543	0.4057	0.0950	0.0350	0.3684	0.1315	0.0	0.0	-9.0000	0.0
W	790626	3	3	0.0233	0.0094	0.4041	0.4693	0.0733	0.0125	0.1701	0.7206	0.0500	0.0125	0.2494	0.4961
W	790630	6	1	0.0883	0.0745	0.8432	0.7965	0.2600	-9.0000	-9.0000	4.0833	0.1717	-9.0000	-9.0000	2.6961
W	790724	10	4	0.0830	0.0482	0.5804	0.7540	0.0675	0.0653	0.9679	0.5811	0.0243	0.0420	1.7320	0.1569
W	790728	2	0	0.0500	0.0400	0.8000	0.5245	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790817	5	2	0.0460	0.0136	0.2949	0.3104	0.0300	0.0200	0.6667	0.2900	0.0020	0.0020	1.0000	0.0186
W	790822	7	0	0.0214	0.0136	0.6325	0.2740	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	3	0.0700	0.0927	1.3248	1.1538	0.0200	0.0141	0.7071	0.2639	0.0	0.0	-9.0000	0.0
W	790829	8	5	0.0112	0.0033	0.2940	0.1529	0.0200	0.0063	0.3162	0.2336	0.0090	0.0059	0.6597	0.1024
		MEAN		0.0725	0.0425	0.5514	0.6864	0.0930	0.0251	0.4504	1.0375	0.0328	0.0129	0.8477	0.4578
		STDV		0.0379	0.0324	0.2883	0.3720	0.0640	0.0186	0.2836	1.2628	0.0453	0.0145	0.5182	0.7775
		COV		0.5225	0.7611	0.5229	0.5419	0.6886	0.7397	0.6295	1.2172	1.3803	1.1220	0.6114	1.6984
		NN		16.0000	16.0000	16.0000	16.0000	12.0000	8.0000	8.0000	12.0000	12.0000	8.0000	6.0000	12.0000

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     NA
                            HACK                                  PLUM                                   EXSS
                  -----------------------------------  ------------------------------------  ---------------------------------
     F   DATE   BN  PN   MEAN    STDV     COV   MN DPO    MEAN    STDV     COV   MN DPO      MEAN    STDV     COV   MN DPO
     C  780828   3   3  0.1000  0.0510  0.5099  0.6775   0.0300  0.0000  0.0009  0.2493     0.0     0.0   -9.0000  0.0
     C  780829   5   1  0.0720  0.0232  0.3216  0.5617   0.0800 -9.0000 -9.0000  0.3118     0.0080 -9.0000 -9.0000  0.0312
     C  780911   0   3 -9.0000 -9.0000 -9.0000 -9.0000   0.1500  0.0852  0.5683  0.3971    -9.0000 -9.0000 -9.0000 -9.0000
     C  780915   2   1  0.1200  0.0400  0.3333  0.1545   0.4200 -9.0000 -9.0000  0.9376     0.3000 -9.0000 -9.0000  0.6697
     C  790623   1   1  0.0300 -9.0000 -9.0000  0.0242   0.0500 -9.0000 -9.0000  0.0471     0.0200 -9.0000 -9.0000  0.0189
     C  790701   3   1  0.0733  0.0047  0.0643  1.3353   0.0200 -9.0000 -9.0000  0.5501     0.0    -9.0000 -9.0000  0.0
     C  790725   3  10  0.1633  0.2098  1.2846  7.4188   0.0520  0.0337  0.6482  1.0389     0.0     0.0   -9.0000  0.0
     C  790801   2   4  0.0100  0.0     0.0     0.0914   0.0375  0.0476  1.2702  0.2384     0.0275  0.0476  1.7320  0.1740
     C  790802   2   8  0.0250  0.0050  0.2000  0.1011   0.0562  0.0620  1.1029  0.3658     0.0375  0.0577  1.5391  0.2147
     C  790806   4   2  0.0275  0.0148  0.5378  0.3344   0.0400  0.0000  0.0007  0.5490     0.0125  0.0000  0.0006  0.1716
     C  790809   8   3  0.0437  0.0283  0.6459  0.1914   0.0267  0.0125  0.4677  0.1014     0.0     0.0   -9.0000  0.0
     C  790820   2   4  0.0400  0.0100  0.2500  0.3395   0.0775  0.0719  0.9277  0.2553     0.0500  0.0612  1.2247  0.1075
     C  790827   1   9  0.1200 -9.0000 -9.0000  0.4167   0.0778  0.0781  1.0047  0.4690     0.0178  0.0503  2.8284  0.1178
     C  790910   6   3  0.0583  0.0389  0.6670  0.4444   0.0433  0.0047  0.1088  0.3545     0.0     0.0   -9.0000  0.0
     C  791011   7   4  0.0214  0.0136  0.6325  0.3067   0.0425  0.0349  0.8214  0.7127     0.0243  0.0322  1.3278  0.4095

         ---------------------------------------------------------------------------------------------------------------
                 MEAN   0.0646  0.0366  0.4539  0.8855   0.0802  0.0392  0.6292  0.4385     0.0355  0.0249  1.4421  0.1368
                 STDV   0.0442  0.0544  0.3304  1.8398   0.0959  0.0306  0.4257  0.2728     0.0749  0.0259  0.8320  0.1865
                 COV    0.6838  1.4871  0.7280  2.0776   1.1948  0.7821  0.6765  0.6222     2.1070  1.0400  0.5769  1.3634
                 NN    14.0000 12.0000 12.0000 14.0000  15.0000 11.0000 11.0000 15.0000    14.0000 10.0000  6.0000 14.0000
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K F	DATE	HN	PN	HACK MEAN	HACK STDV	HACK COV	HACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	0.0300	0.0063	0.2108	0.4174	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0600	0.0141	0.2357	1.0635	0.0800	-9.0000	-9.0000	2.5769	0.0200	-9.0000	-9.0000	0.6442
W	780906	2	3	0.0650	0.0050	0.0769	0.7424	0.1100	0.0510	0.4635	0.8381	0.0467	0.0494	1.0583	0.4470
W	780909	2	1	0.1100	0.0100	0.0909	0.5390	0.0800	-9.0000	-9.0000	0.4649	0.0	-9.0000	-9.0000	0.0
W	780910	4	2	0.0675	0.0148	0.2191	0.3361	0.1200	0.0200	0.1667	0.5230	0.0525	0.0200	0.3810	0.2408
W	780914	7	0	0.0414	0.0210	0.5068	0.6302	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	7	1	0.1143	0.0665	0.5820	0.8398	0.0700	-9.0000	-9.0000	0.5785	0.0	-9.0000	-9.0000	0.0
W	790621	4	1	0.3525	0.2417	0.6857	0.7791	0.3400	-9.0000	-9.0000	0.3855	0.0	-9.0000	-9.0000	0.0
W	790626	3	3	0.0567	0.0189	0.3328	1.1481	0.1333	0.0205	0.1541	1.3007	0.0767	0.0205	0.2680	0.7553
W	790630	6	1	0.1350	0.1412	1.0456	1.9442	0.0300	-9.0000	-9.0000	0.4712	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0820	0.0685	0.8357	0.7076	0.1300	0.1120	0.8617	1.5046	0.0765	0.0858	1.1218	0.9240
W	790728	2	1	0.0850	0.0050	0.0588	0.6507	0.0300	-9.0000	-9.0000	0.0623	0.0	-9.0000	-9.0000	0.0
W	790817	5	2	0.3280	0.5763	1.7570	2.8549	0.0200	0.0100	0.5000	0.1969	0.0	0.0	-9.0000	0.0
W	790822	7	0	0.0314	0.0196	0.6232	0.3314	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790823	4	3	0.0900	0.0682	0.7577	1.4694	0.0300	0.0000	0.0009	0.3124	0.0	0.0	-9.0000	0.0
W	790829	8	5	0.0575	0.1076	1.8706	0.8279	0.0300	0.0167	0.5578	0.2670	0.0005	0.0010	2.0000	0.0026
	MEAN			0.1066	0.0865	0.6181	0.9552	0.0926	0.0329	0.3864	0.7294	0.0210	0.0253	0.9658	0.2318
	STDV			0.0924	0.1409	0.5344	0.6373	0.0818	0.0354	0.2739	0.6673	0.0295	0.0297	0.6215	0.3280
	COV			0.8702	1.6285	0.8647	0.6672	0.8843	1.0760	0.7088	0.9149	1.4072	1.1752	0.6435	1.4147
	NN			15.0000	16.0000	16.0000	16.0000	13.0000	7.0000	7.0000	13.0000	13.0000	7.0000	5.0000	13.0000

K				HACK				PLUM				EXSS			
F	DATE	HN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	3	3	0.1133	0.0974	0.8595	0.8738	0.0233	0.0047	0.2020	0.1935	0.0	0.0	-9.0000	0.0
C	780829	5	2	0.0580	0.0366	0.6302	0.4866	0.2100	0.1500	0.7143	0.5953	0.1520	0.1500	0.9868	0.4052
C	780911	0	3	-9.0000	-9.0000	-9.0000	-9.0000	0.0800	0.0245	0.3062	0.2099	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	2	1	0.0850	0.0050	0.0588	0.1086	0.1200	-9.0000	-9.0000	0.2679	0.0350	-9.0000	-9.0000	0.0781
C	790623	1	1	0.1700	-9.0000	-9.0000	0.1373	0.0900	-9.0000	-9.0000	0.0848	0.0	-9.0000	-9.0000	0.0
C	790701	3	1	0.0467	0.0236	0.5051	0.7967	0.0100	-9.0000	-9.0000	0.2751	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0967	0.1156	1.1955	4.2229	0.0200	0.0155	0.7746	0.3847	0.0	0.0	-9.0000	0.0
C	790801	2	4	0.0100	0.0	0.0	0.0914	0.0900	0.1386	1.5396	0.5707	0.0800	0.1386	1.7321	0.5063
C	790802	2	8	0.0150	0.0050	0.3333	0.0579	0.0462	0.0667	1.4421	0.2825	0.0331	0.0657	1.9838	0.1709
C	790806	4	2	0.0350	0.0180	0.5151	0.4205	0.2100	0.1500	0.7143	3.0836	0.1750	0.1500	0.8571	2.6032
C	790809	8	3	0.0625	0.0455	0.7277	0.2788	0.0400	0.0424	1.0607	0.1966	0.0125	0.0177	1.4142	0.0654
C	790820	2	2	0.0200	0.0	0.0	0.1859	0.0100	0.0	0.0	0.1886	0.0	0.0	-9.0000	0.0
C	790827	1	9	0.2400	-9.0000	-9.0000	0.8335	0.0889	0.0661	0.7433	0.6233	0.0022	0.0063	2.8284	0.0217
C	790910	6	3	0.1000	0.1085	1.0847	0.8179	0.0200	0.0082	0.4082	0.1606	0.0	0.0	-9.0000	0.0
C	791011	7	4	0.0371	0.0433	1.1666	0.4822	0.0625	0.0363	0.5810	0.9928	0.0296	0.0318	1.0719	0.5052
	MEAN			0.0778	0.0415	0.5897	0.6996	0.0747	0.0586	0.7072	0.5407	0.0371	0.0509	1.5535	0.3111
	STDV			0.0621	0.0409	0.4177	1.0192	0.0625	0.0547	0.4458	0.7184	0.0562	0.0613	0.6436	0.6621
	COV			0.7977	0.9859	0.7084	1.4569	0.8358	0.9335	0.6304	1.3288	1.5145	1.2046	0.4143	2.1279
	NN			14.0000	12.0000	12.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	7.0000	14.0000

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 F
                               HACK                                 PLUM                                         EXSS
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 F     DATE    BU   PN   MEAN     STDV      COV   MN DPO       MEAN     STDV      COV   MN DPO          MEAN     STDV      COV   MN DPO

 W    780827    0    0 -9.0000  -9.0000  -9.0000  -9.0000     -9.0000  -9.0000  -9.0000  -9.0000       -9.0000  -9.0000  -9.0000  -9.0000
 W    780902    4    1  0.0300   0.0346   1.1547   1.0712      0.0100  -9.0000  -9.0000   0.3221        0.0     -9.0000  -9.0000   0.0
 W    780906    2    3  0.0250   0.0050   0.2000   0.2605      0.0467   0.0170   0.3642   0.3403        0.0217   0.0170   0.7845   0.1879
 W    780909    2    1  0.0450   0.0150   0.3333   0.2110      0.0100  -9.0000  -9.0000   0.0581        0.0     -9.0000  -9.0000   0.0
 W    780910    4    3  0.0275   0.0192   0.6983   0.1629      0.0433   0.0189   0.4351   0.1589        0.0158   0.0189   1.1909   0.0514
 W    780914    7    0  0.0229   0.0070   0.3062   0.3514     -9.0000  -9.0000  -9.0000  -9.0000       -9.0000  -9.0000  -9.0000  -9.0000
 W    790609    8    1  0.0400   0.0000   0.0007   0.3770      0.0400  -9.0000  -9.0000   0.3305        0.0000  -9.0000  -9.0000   0.0000
 W    790621    6    2  0.0483   0.0121   0.2510   0.1099      0.0450   0.0050   0.1111   0.0669        0.0008   0.0008   1.0000   0.0009
 W    790626    3    3  0.0400   0.0000   0.0009   0.8378      0.0400   0.0000   0.0009   0.3850        0.0000   0.0      0.0      0.0000
 W    790630    6    1  0.0383   0.0037   0.0972   0.5707      0.0400  -9.0000  -9.0000   0.6282        0.0017  -9.0000  -9.0000   0.0262
 W    790724   10    4  0.0400   0.0000   0.0008   0.4300      0.0400   0.0000   0.0009   0.4378        0.0000   0.0      0.0      0.0000
 W    790728    2    1  0.0350   0.0050   0.1429   0.2792      0.0500  -9.0000  -9.0000   0.1038        0.0150  -9.0000  -9.0000   0.0311
 W    790817    5    2  0.0612   0.0564   0.9209   0.4571      0.1015   0.0075   0.0739   1.0455        0.0403   0.0075   0.1861   0.4103
 W    790822    7    0  0.0700   0.0764   1.0915   0.9531     -9.0000  -9.0000  -9.0000  -9.0000       -9.0000  -9.0000  -9.0000  -9.0000
 W    790823    4    3  0.0483   0.0422   0.8738   0.7962      0.0300   0.0188   0.6278   0.3958        0.0      0.0     -9.0000   0.0
 W    790829    8    5  0.0227   0.0047   0.2059   0.3172      0.0424   0.0390   0.9202   0.7933        0.0211   0.0381   1.8035   0.5339

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               MEAN     0.0396   0.0188   0.4185   0.4790      0.0415   0.0133   0.3168   0.3897        0.0090   0.0103   0.7093   0.0955

               STDV     0.0132   0.0225   0.3980   0.2904      0.0212   0.0122   0.3118   0.2790        0.0123   0.0128   0.6324   0.1697

               COV      0.3330   1.1989   0.9510   0.6062      0.5113   0.9184   0.9844   0.7159        1.3767   1.2430   0.8916   1.7767

               NN      15.0000  15.0000  15.0000  15.0000     13.0000   8.0000   8.0000  13.0000       13.0000   8.0000   7.0000  13.0000
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  F
                                 BACK                                       PLUM                                       EXSS
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  F    DATE   BN   PN    MEAN     STDV      COV   MN DPO           MEAN     STDV      COV   MN DPO           MEAN     STDV      COV   MN DPO

  C  780828    2    0  0.0200   0.0100   0.5000   0.1524        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
  C  780829    3    1  0.0200   0.0082   0.4082   0.1318         0.0200  -9.0000  -9.0000   0.0780         0.0     -9.0000  -9.0000   0.0
  C  780911    0    3 -9.0000  -9.0000  -9.0000  -9.0000         0.0267   0.0094   0.3536   0.0732        -9.0000  -9.0000  -9.0000  -9.0000

  C  780915    0    0 -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000        -9.0000  -9.0000  -9.0000  -9.0000
  C  790623    2    3  0.0400   0.0000   0.0007   0.0244         0.0400   0.0000   0.0009   0.0269         0.0000   0.0      0.0      0.0000
  C  790701    3    1  0.0400   0.0000   0.0009   0.7350         0.0400  -9.0000  -9.0000   1.1002         0.0000  -9.0000  -9.0000   0.0000

  C  790725    3   10  0.0400   0.0000   0.0009   0.7693         0.0390   0.0030   0.0769   0.6914         0.0000   0.0000   0.3333   0.0000
  C  790801    2    5  0.0400   0.0000   0.0007   0.3654         0.0388   0.0024   0.0619   0.2105         0.0000   0.0000   0.5000   0.0000
  C  790802    3    8  0.0283   0.0165   0.5823   0.0800         0.0400   0.0000   0.0007   0.3561         0.0117   0.0000   0.0011   0.1039

  C  790806    4    2  0.0227   0.0173   0.7584   0.3687         0.0400   0.0000   0.0007   0.5490         0.0173   0.0      0.0      0.2367
  C  790809    8    2  0.0320   0.0139   0.4355   0.1602         0.0140   0.0080   0.5714   0.0737         0.0      0.0     -9.0000   0.0
  C  790820    2    4  0.0575   0.0525   0.9130   0.3650         0.0570   0.0087   0.1534   0.5351         0.0038   0.0043   1.1489   0.0149

  C  790827    1    8  0.0100  -9.0000  -9.0000   0.0347         0.0227   0.0086   0.3780   0.1375         0.0134   0.0074   0.5519   0.0786
  C  790910    6    3  0.0125   0.0041   0.3258   0.1124         0.0153   0.0019   0.1230   0.1261         0.0028   0.0019   0.6655   0.0233
  C  791011    7    4  0.0114   0.0035   0.3062   0.1886         0.0125   0.0043   0.3464   0.1708         0.0021   0.0037   1.7320   0.0165

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                 MEAN  0.0288   0.0105   0.3527   0.2683         0.0312   0.0042   0.1879   0.3176         0.0043   0.0017   0.5481   0.0393
                 STDV  0.0137   0.0141   0.2974   0.2356         0.0130   0.0036   0.1845   0.3061         0.0059   0.0025   0.5502   0.0680
                 COV   0.4764   1.3440   0.8431   0.8781         0.4173   0.8563   0.9820   0.9638         1.3954   1.4212   1.0039   1.7282
                 NN   13.0000  12.0000  12.0000  13.0000        13.0000  11.0000  11.0000  13.0000        12.0000  10.0000   9.0000  12.0000
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FE
                        HACK                                   PLUM                                   EXSS
                        ----------------------------------     ----------------------------------     ----------------------------------
F   DATE    BN  PN      MEAN    STDV     COV      MN DPO       MEAN     STDV     COV      MN DPO      MEAN     STDV     COV      MN DPO

W   780827   5   0      0.0202  0.0143   0.7101   0.2511      -9.0000  -9.0000  -9.0000  -9.0000     -9.0000  -9.0000  -9.0000  -9.0000
W   780902   4   1      0.0322  0.0131   0.4063   0.5091       0.0870  -9.0000  -9.0000   2.8024      0.0548  -9.0000  -9.0000   1.7636
W   780906   2   3      0.0865  0.0055   0.0636   0.4973       0.1167   0.0082   0.0705   0.7355      0.0302   0.0082   0.2725   0.2082
W   780909   2   1      0.0625  0.0445   0.7120   0.2725       0.1190  -9.0000  -9.0000   0.6916      0.0565  -9.0000  -9.0000   0.3283
W   780910   4   3      0.0712  0.0430   0.6030   0.4261       0.1960   0.0711   0.3629   0.7485      0.1248   0.0711   0.5701   0.4700
W   780914   7   0      0.0201  0.0214   1.0619   0.2927      -9.0000  -9.0000  -9.0000  -9.0000     -9.0000  -9.0000  -9.0000  -9.0000
W   790609   8   1      0.0195  0.0075   0.3872   0.1776       0.0460  -9.0000  -9.0000   0.3801      0.0265  -9.0000  -9.0000   0.2190
W   790621   6   2      0.0267  0.0082   0.3075   0.0627       0.0855   0.0485   0.5673   0.1116      0.0588   0.0485   0.8244   0.0708
W   790625   2   1      0.0220  0.0      0.0      0.4069       0.0450  -9.0000  -9.0000   0.1387      0.0230  -9.0000  -9.0000   0.0709
W   790630   3   1      0.0210  0.0016   0.0778   0.2510       0.0140  -9.0000  -9.0000   0.2199      0.0     -9.0000  -9.0000   0.0
W   790724  10   4      0.0425  0.0377   0.8801   0.4022       0.0500   0.0355   0.7106   0.5793      0.0174   0.0282   1.6273   0.2277
W   790728   2   1      0.0260  0.0060   0.2308   0.2161       0.0440  -9.0000  -9.0000   0.0914      0.0180  -9.0000  -9.0000   0.0374
W   790817   6   2      0.0963  0.0652   0.6769   0.6512       0.1500   0.0620   0.4133   1.4907      0.0578   0.0578   1.0000   0.5386
W   790822   8   2      0.0535  0.0349   0.6529   0.6067       0.0735   0.0085   0.1156   0.1884      0.0200   0.0085   0.4250   0.0552
W   790823   6   5      0.0153  0.0055   0.3585   0.2305       0.0648   0.0419   0.6465   0.8593      0.0495   0.0419   0.8469   0.6952
W   790829   6   5      0.0100  0.0077   0.7681   0.1230       0.0392   0.0137   0.3492   0.3968      0.0292   0.0137   0.4688   0.2788
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                MEAN    0.0391  0.0198   0.4935   0.3673       0.0808   0.0362   0.4045   0.6739      0.0405   0.0347   0.7544   0.3545
                STDV    0.0260  0.0187   0.3016   0.2281       0.0479   0.0227   0.2176   0.6968      0.0294   0.0223   0.4019   0.4382
                COV     0.6650  0.9456   0.6111   0.6211       0.5935   0.6277   0.5379   1.0340      0.7271   0.6415   0.5327   1.2358
                NN     16.0000 16.0000  16.0000  16.0000      14.0000   8.0000   8.0000  14.0000     14.0000   8.0000   8.0000  14.0000
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FE

F	DATE	BN	PN	BACK MEAN	BACK STDV	BACK COV	BACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
C	790828	2	2	0.0135	0.0015	0.1111	0.0869	0.0260	0.0150	0.5769	0.2324	0.0138	0.0137	1.0000	0.1257
C	790829	5	2	0.0522	0.0571	1.0932	0.2527	0.0530	0.0270	0.5094	0.1905	0.0139	0.0139	1.0000	0.0542
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0375	0.0145	0.3867	0.1066	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0370	-9.0000	-9.0000	0.0485	0.0570	-9.0000	-9.0000	0.1273	0.0200	-9.0000	-9.0000	0.0446
C	790623	1	1	0.0100	-9.0000	-9.0000	0.0081	0.0550	-9.0000	-9.0000	0.0238	0.0450	-9.0000	-9.0000	0.0195
C	790701	1	1	0.0130	-9.0000	-9.0000	0.1915	0.0050	-9.0000	-9.0000	0.1375	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0027	0.0017	0.6374	0.0289	0.0220	0.0188	0.8535	0.4436	0.0193	0.0188	0.9713	0.3962
C	790801	2	4	0.0325	0.0275	0.8462	0.2236	0.0410	0.0280	0.6840	0.2868	0.0172	0.0199	1.1530	0.1261
C	790802	3	8	0.0183	0.0118	0.6428	0.0478	0.0529	0.0644	1.2184	0.4540	0.0360	0.0636	1.7653	0.3012
C	790806	4	2	0.0115	0.0027	0.2341	0.1478	0.0305	0.0155	0.5082	0.4394	0.0190	0.0155	0.8158	0.2816
C	790809	8	2	0.0379	0.0270	0.7123	0.1668	0.0205	0.0155	0.7561	0.1073	0.0	0.0	-9.0000	0.0
C	790820	2	5	0.0100	0.0030	0.3000	0.1026	0.1566	0.0961	0.6138	0.6619	0.1466	0.0961	0.6556	0.5675
C	790827	1	9	0.0260	-9.0000	-9.0000	0.0903	0.0838	0.0647	0.7728	0.5113	0.0581	0.0644	1.1089	0.3549
C	790910	6	3	0.0257	0.0121	0.4722	0.2293	0.0657	0.0159	0.2425	0.5342	0.0400	0.0159	0.3981	0.3231
C	791011	7	4	0.0224	0.0110	0.4924	0.3243	0.0425	0.0227	0.5346	0.6788	0.0201	0.0227	1.1320	0.3338
	MEAN			0.0223	0.0155	0.5542	0.1392	0.0499	0.0332	0.6381	0.3290	0.0321	0.0313	1.0000	0.2092
	STDV			0.0131	0.0166	0.2810	0.0919	0.0344	0.0257	0.2390	0.2080	0.0355	0.0282	0.3397	0.1722
	COV			0.5943	1.0683	0.5070	0.6605	0.6894	0.7740	0.3746	0.6321	1.1057	0.9017	0.3397	0.8234
	NN			14.0000	10.0000	10.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	10.0000	14.0000

CU

F	DATE	BN	PN	BACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	0.0010	0.0000	0.0013	0.0136	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0027	0.0019	0.6943	0.0816	0.0090	-9.0000	-9.0000	0.2899	0.0063	-9.0000	-9.0000	0.2013
W	780906	2	3	0.0055	0.0025	0.4545	0.0866	0.0360	0.0080	0.2234	0.1930	0.0305	0.0080	0.2637	0.1595
W	780909	2	1	0.0020	0.0010	0.5000	0.0091	0.0100	-9.0000	-9.0000	0.0581	0.0080	-9.0000	-9.0000	0.0465
W	780910	4	3	0.0062	0.0070	1.1164	0.0359	0.0140	0.0016	0.1166	0.0562	0.0078	0.0016	0.2107	0.0317
W	780914	7	0	0.0026	0.0031	1.2095	0.0375	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	2	0.0022	0.0007	0.2940	0.0199	0.0130	0.0040	0.3077	0.1138	0.0107	0.0040	0.3721	0.0936
W	790621	6	3	0.0034	0.0023	0.5914	0.0094	0.0673	0.0649	0.9636	0.0865	0.0635	0.0649	1.0218	0.0804
W	790626	2	1	0.0010	0.0	0.0	0.0185	0.0020	-9.0000	-9.0000	0.0062	0.0010	-9.0000	-9.0000	0.0031
W	790630	3	1	0.0020	0.0008	0.4082	0.0227	0.0070	-9.0000	-9.0000	0.1099	0.0050	-9.0000	-9.0000	0.0785
W	790724	10	4	0.0031	0.0016	0.5291	0.0337	0.0225	0.0131	0.5833	0.2700	0.0194	0.0131	0.6765	0.2361
W	790729	2	1	0.0045	0.0045	0.5244	0.0804	0.0170	-9.0000	-9.0000	0.0353	0.0085	-9.0000	-9.0000	0.0177
W	790817	6	2	0.0028	0.0007	0.2425	0.0219	0.0440	0.0170	0.3864	0.4748	0.0412	0.0170	0.4130	0.4454
W	790822	8	3	0.0022	0.0015	0.6573	0.0246	0.0853	0.0649	0.7604	0.5369	0.0831	0.0649	0.7810	0.5272
W	790823	7	5	0.0023	0.0020	0.8660	0.0355	0.0442	0.0432	0.9763	0.6355	0.0422	0.0428	1.0145	0.6128
W	790829	8	5	0.0022	0.0019	0.8535	0.0322	0.0218	0.0096	0.4394	0.3092	0.0195	0.0096	0.4900	0.2826
		MEAN		0.0031	0.0020	0.5595	0.0352	0.0281	0.0251	0.5286	0.2268	0.0248	0.0251	0.5826	0.2012
		STDV		0.0019	0.0017	0.3333	0.0245	0.0236	0.0241	0.2956	0.1941	0.0237	0.0241	0.2885	0.1912
		COV		0.6145	0.8706	0.5958	0.6968	0.8421	0.9586	0.5592	0.8559	0.9589	0.9589	0.4953	0.9504
		NN		15.0000	16.0000	16.0000	16.0000	14.0000	9.0000	9.0000	14.0000	14.0000	9.0000	9.0000	14.0000

CU F	DATE	BN	PN	HACK				PLUM				EXSS			
				MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	2	2	0.0010	0.0	0.0	0.0061	0.0150	0.0100	0.6667	0.1347	0.0140	0.0100	0.7143	0.1261
C	780829	5	2	0.0078	0.0078	1.0043	0.0522	0.0420	0.0250	0.5952	0.1532	0.0342	0.0250	0.7310	0.1276
C	790911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0145	0.0025	0.1724	0.0399	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0110	-9.0000	-9.0000	0.0144	0.0220	-9.0000	-9.0000	0.0491	0.0110	-9.0000	-9.0000	0.0246
C	790623	2	1	0.0015	0.0005	0.3333	0.0014	0.0030	-9.0000	-9.0000	0.0013	0.0015	-9.0000	-9.0000	0.0006
C	790701	1	1	0.0010	-9.0000	-9.0000	0.0147	0.0020	-9.0000	-9.0000	0.0550	0.0010	-9.0000	-9.0000	0.0275
C	790725	3	10	0.0020	0.0008	0.4083	0.0396	0.0187	0.0252	1.3499	0.4003	0.0167	0.0252	1.5116	0.3647
C	790801	2	5	0.0045	0.0015	0.3333	0.0371	0.0176	0.0117	0.6642	0.1046	0.0131	0.0117	0.8923	0.0758
C	790802	4	8	0.0060	0.0037	0.6124	0.0191	0.0532	0.0878	1.6495	0.4391	0.0474	0.0878	1.8526	0.3878
C	790806	6	2	0.0047	0.0048	1.0326	0.0527	0.0055	0.0005	0.0909	0.0762	0.0008	0.0005	0.6000	0.0121
C	790809	9	2	0.0037	0.0015	0.4066	0.0170	0.0090	0.0080	0.8889	0.0471	0.0067	0.0067	1.0000	0.0349
C	790820	2	6	0.0040	0.0030	0.7500	0.0469	0.0758	0.0486	0.6407	0.3071	0.0718	0.0486	0.6764	0.2733
C	790827	1	9	0.0030	-9.0000	-9.0000	0.0104	0.0773	0.1075	1.3896	0.4782	0.0746	0.1073	1.4393	0.4611
C	790910	7	3	0.0016	0.0005	0.3149	0.0108	0.0397	0.0073	0.1845	0.3291	0.0381	0.0073	0.1921	0.3162
C	791011	7	4	0.0043	0.0035	0.8246	0.0617	0.0252	0.0229	0.9089	0.4338	0.0210	0.0229	1.0947	0.3679
		MEAN		0.0040	0.0025	0.5473	0.0274	0.0280	0.0298	0.7668	0.2032	0.0251	0.0321	0.9731	0.1857
		STDV		0.0027	0.0022	0.3091	0.0194	0.0237	0.0331	0.4793	0.1674	0.0239	0.0335	0.4538	0.1612
		COV		0.6798	0.8943	0.5647	0.7062	0.8463	1.1124	0.6251	0.8238	0.9511	1.0450	0.4664	0.8679
		NN		14.0000	11.0000	11.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	11.0000	14.0000

NI

F	DATE	BW	PN	HACK MEAN	HACK STDV	HACK COV	HACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	0.0010	0.0000	0.0013	0.0136	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0012	0.0004	0.3464	0.0302	0.0030	-9.0000	-9.0000	0.0966	0.0018	-9.0000	-9.0000	0.0564
W	780906	2	3	0.0015	0.0005	0.3333	0.0221	0.0170	0.0059	0.3463	0.0874	0.0155	0.0059	0.3799	0.0782
W	780909	2	1	0.0010	0.0	0.0	0.0050	0.0040	-9.0000	-9.0000	0.0232	0.0030	-9.0000	-9.0000	0.0174
W	780910	4	3	0.0015	0.0005	0.3333	0.0080	0.0047	0.0012	0.2673	0.0186	0.0032	0.0012	0.3939	0.0127
W	780914	7	0	0.0014	0.0010	0.7348	0.0219	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	2	0.0010	0.0000	0.0017	0.0094	0.0065	0.0005	0.0769	0.0579	0.0055	0.0005	0.0909	0.0490
W	790621	6	3	0.0018	0.0007	0.3748	0.0044	0.0530	0.0503	0.9492	0.0676	0.0512	0.0503	0.9832	0.0647
W	790626	2	1	0.0010	0.0	0.0	0.0185	0.0010	-9.0000	-9.0000	0.0031	0.0	-9.0000	-9.0000	0.0
W	790630	3	1	0.0017	0.0009	0.5657	0.0268	0.0010	-9.0000	-9.0000	0.0157	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0020	0.0024	1.1832	0.0174	0.0127	0.0064	0.5034	0.1598	0.0107	0.0064	0.5970	0.1379
W	790729	2	1	0.0020	0.0010	0.5000	0.0187	0.0070	-9.0000	-9.0000	0.0145	0.0050	-9.0000	-9.0000	0.0106
W	790817	6	2	0.0012	0.0004	0.3194	0.0083	0.0365	0.0205	0.5616	0.3570	0.0353	0.0205	0.5802	0.3449
W	790822	6	3	0.0011	0.0003	0.2940	0.0124	0.0257	0.0149	0.5799	0.1451	0.0245	0.0149	0.6065	0.1403
W	790823	7	5	0.0010	0.0000	0.0017	0.0164	0.0192	0.0169	0.8780	0.2693	0.0182	0.0169	0.9262	0.2585
W	790829	8	5	0.0014	0.0007	0.5062	0.0204	0.0066	0.0042	0.6400	0.1078	0.0053	0.0041	0.7785	0.0920
		MEAN		0.0014	0.0006	0.3435	0.0158	0.0141	0.0134	0.5336	0.1017	0.0128	0.0134	0.5929	0.0902
		STDV		0.0003	0.0006	0.3112	0.0074	0.0147	0.0146	0.2627	0.0999	0.0146	0.0147	0.2657	0.0984
		COV		0.2546	1.0609	0.9060	0.4651	1.0368	1.0908	0.4923	0.9820	1.1373	1.0922	0.4481	1.0913
		NN		16.0000	16.0000	16.0000	16.0000	14.0000	9.0000	9.0000	14.0000	14.0000	9.0000	9.0000	14.0000

NI				HACK				PLUM				EXSS			
F	DATE	HN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	2	2	0.0010	0.0	0.0	0.0061	0.0045	0.0025	0.5556	0.0402	0.0035	0.0025	0.7143	0.0315
C	780829	5	2	0.0024	0.0023	0.9718	0.0170	0.0260	0.0230	0.8846	0.0995	0.0236	0.0230	0.9746	0.0916
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0045	0.0025	0.5556	0.0129	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0020	-9.0000	-9.0000	0.0026	0.0200	-9.0000	-9.0000	0.0446	0.0180	-9.0000	-9.0000	0.0402
C	790623	2	1	0.0010	0.0	0.0	0.0009	0.0020	-9.0000	-9.0000	0.0009	0.0010	-9.0000	-9.0000	0.0004
C	790701	1	1	0.0010	-9.0000	-9.0000	0.0147	0.0010	-9.0000	-9.0000	0.0275	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0017	0.0009	0.5657	0.0513	0.0063	0.0098	1.5521	0.1384	0.0050	0.0096	1.9002	0.1153
C	790801	2	5	0.0010	0.0	0.0	0.0091	0.0050	0.0034	0.6812	0.0303	0.0040	0.0034	0.8515	0.0239
C	790802	4	8	0.0027	0.0020	0.7441	0.0073	0.0135	0.0200	1.4787	0.1100	0.0110	0.0198	1.8082	0.0893
C	790806	6	2	0.0020	0.0012	0.5774	0.0243	0.0035	0.0025	0.7143	0.0514	0.0020	0.0020	1.0000	0.0301
C	790809	9	2	0.0017	0.0009	0.5657	0.0075	0.0105	0.0095	0.9048	0.0549	0.0092	0.0092	1.0000	0.0479
C	790820	2	6	0.0020	0.0010	0.5000	0.0218	0.0335	0.0215	0.6406	0.1102	0.0317	0.0212	0.6698	0.0987
C	790827	1	9	0.0010	-9.0000	-9.0000	0.0035	0.0448	0.0659	1.4726	0.2791	0.0438	0.0659	1.5062	0.2730
C	790910	7	3	0.0015	0.0010	0.6680	0.0112	0.0320	0.0261	0.8153	0.2724	0.0304	0.0261	0.8574	0.2595
C	791011	7	4	0.0020	0.0014	0.7071	0.0341	0.0190	0.0221	1.1609	0.3370	0.0170	0.0221	1.2975	0.3063
	MEAN			0.0016	0.0010	0.4818	0.0151	0.0151	0.0174	0.9513	0.1073	0.0143	0.0186	1.1436	0.1006
	STDV			0.0006	0.0007	0.3183	0.0135	0.0132	0.0171	0.3558	0.1024	0.0131	0.0172	0.4062	0.1000
	COV			0.3397	0.7510	0.6606	0.8928	0.8728	0.9806	0.3739	0.9549	0.9191	0.9266	0.3552	0.9941
	VN			14.0000	11.0000	11.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	11.0000	14.0000

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PB
                            HACK                                     PLUM                                      EXSS
                   ---------------------------------  ---------------------------------  ---------------------------------
F    DATE   BN  PN    MEAN    STDV     COV  MN DPO      MEAN    STDV     COV  MN DPO      MEAN    STDV     COV  MN DPO

W   780827   5   0  0.0100  0.0026  0.2608  0.1247   -9.0000 -9.0000 -9.0000 -9.0000   -9.0000 -9.0000 -9.0000 -9.0000
W   780902   4   1  0.0093  0.0023  0.2462  0.1478    0.0120 -9.0000 -9.0000  0.3865    0.0027 -9.0000 -9.0000  0.0886
W   780905   2   3  0.0105  0.0035  0.3333  0.0980    0.0140  0.0022  0.1543  0.0782    0.0035  0.0022  0.6172  0.0142
W   780909   2   1  0.0135  0.0035  0.2593  0.0642    0.0220 -9.0000 -9.0000  0.1279    0.0085 -9.0000 -9.0000  0.0494
W   780910   4   3  0.0115  0.0021  0.1793  0.0629    0.0267  0.0039  0.1447  0.1077    0.0152  0.0039  0.2544  0.0628
W   780914   7   0  0.0116  0.0040  0.3421  0.1861   -9.0000 -9.0000 -9.0000 -9.0000   -9.0000 -9.0000 -9.0000 -9.0000
W   790609   8   1  0.0120  0.0012  0.1021  0.1098    0.0140 -9.0000 -9.0000  0.1157    0.0020 -9.0000 -9.0000  0.0165
W   790621   6   2  0.0068  0.0011  0.1562  0.0155    0.0295  0.0185  0.6271  0.0378    0.0227  0.0185  0.8162  0.0274
W   790626   2   1  0.0105  0.0005  0.0476  0.1969    0.0140 -9.0000 -9.0000  0.0432    0.0035 -9.0000 -9.0000  0.0108
W   790630   3   1  0.0163  0.0021  0.1258  0.1724    0.0160 -9.0000 -9.0000  0.2513    0.0     -9.0000 -9.0000  0.0
W   790724  10   4  0.0087  0.0016  0.1784  0.0913    0.0115  0.0040  0.3505  0.1137    0.0032  0.0036  1.1166  0.0247
W   790728   2   1  0.0255  0.0145  0.5686  0.1340    0.0320 -9.0000 -9.0000  0.0664    0.0065 -9.0000 -9.0000  0.0135
W   790817   6   2  0.0199  0.0047  0.2354  0.1534    0.0360  0.0100  0.2778  0.3630    0.0162  0.0100  0.6186  0.1571
W   790822   8   2  0.0085  0.0027  0.3222  0.0937    0.0160  0.0020  0.1250  0.0411    0.0075  0.0020  0.2667  0.0199
W   790823   6   5  0.0143  0.0022  0.1543  0.2128    0.0290  0.0088  0.3030  0.3043    0.0147  0.0088  0.5991  0.1509
W   790629   8   5  0.0102  0.0015  0.1443  0.1475    0.0156  0.0026  0.1652  0.1758    0.0054  0.0026  0.4816  0.0548

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              MEAN  0.0124  0.0031  0.2285  0.1257    0.0206  0.0065  0.2684  0.1580    0.0080  0.0064  0.5963  0.0493
              STDV  0.0046  0.0031  0.1206  0.0521    0.0081  0.0054  0.1566  0.1159    0.0064  0.0054  0.2643  0.0487
               COV  0.3684  1.0041  0.5279  0.4143    0.3916  0.8245  0.5834  0.7331    0.8070  0.8355  0.4432  0.9865
                NN 16.0000 16.0000 16.0000 16.0000   14.0000  8.0000  8.0000 14.0000   14.0000  8.0000  8.0000 14.0000
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PB F	DATE	BW	PN	HACK MEAN	 STDV	 COV	 MN DPO	PLUM MEAN	 STDV	 COV	 MN DPO	EXSS MEAN	 STDV	 COV	 MN DPO
C	780828	2	2	0.0050	0.0010	0.2000	0.0335	0.0070	0.0020	0.2857	0.0616	0.0020	0.0020	1.0000	0.0183
C	780829	5	2	0.0032	0.0012	0.3644	0.0219	0.0075	0.0045	0.6000	0.0274	0.0044	0.0044	1.0000	0.0172
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0145	0.0015	0.1034	0.0406	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0080	-9.0000	-9.0000	0.0105	0.0110	-9.0000	-9.0000	0.0246	0.0030	-9.0000	-9.0000	0.0067
C	790623	1	1	0.0016	-9.0000	-9.0000	0.0008	0.0040	-9.0000	-9.0000	0.0017	0.0030	-9.0000	-9.0000	0.0013
C	790701	1	1	0.0080	-9.0000	-9.0000	0.1178	0.0100	-9.0000	-9.0000	0.2751	0.0020	-9.0000	-9.0000	0.0550
C	790725	3	10	0.0040	0.0014	0.3536	0.1058	0.0087	0.0037	0.4209	0.1697	0.0047	0.0037	0.7791	0.0985
C	790801	2	4	0.0035	0.0005	0.1429	0.0306	0.0050	0.0012	0.2449	0.0327	0.0015	0.0012	0.8165	0.0101
C	790802	3	8	0.0040	0.0008	0.2041	0.0124	0.0112	0.0113	1.0044	0.1181	0.0072	0.0113	1.5586	0.0825
C	790806	4	2	0.0030	0.0010	0.3333	0.0387	0.0030	0.0000	0.0007	0.0412	0.0000	0.0	0.0	0.0000
C	790809	8	2	0.0055	0.0019	0.3318	0.0250	0.0045	0.0005	0.1111	0.0236	0.0	0.0	-9.0000	0.0
C	790820	2	6	0.0040	0.0	0.0	0.0372	0.0188	0.0054	0.2850	0.1266	0.0148	0.0054	0.3618	0.0928
C	790827	1	9	0.0060	-9.0000	-9.0000	0.0208	0.0268	0.0226	0.8424	0.1611	0.0208	0.0226	1.0857	0.1246
C	790910	6	3	0.0073	0.0011	0.1508	0.0566	0.0127	0.0038	0.2977	0.1041	0.0053	0.0038	0.7071	0.0438
C	791011	7	4	0.0147	0.0031	0.2109	0.2363	0.0195	0.0094	0.4418	0.3046	0.0061	0.0084	1.3594	0.1027
		MEAN		0.0055	0.0012	0.2292	0.0534	0.0109	0.0055	0.3898	0.1008	0.0054	0.0057	0.8668	0.0467
		STDV		0.0032	0.0008	0.1109	0.0603	0.0064	0.0061	0.2885	0.0900	0.0056	0.0063	0.4297	0.0434
		COV		0.5799	0.6620	0.4841	1.1284	0.5888	1.1158	0.7400	0.8929	1.0462	1.0992	0.4958	0.9306
		NN		14.0000	10.0000	10.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	10.0000	14.0000

ZN

F	DATE	BN	PN	HACK MEAN	HACK STDV	HACK COV	HACK MN DPO	PLUM MEAN	PLUM STDV	PLUM COV	PLUM MN DPO	EXSS MEAN	EXSS STDV	EXSS COV	EXSS MN DPO
W	780827	5	0	0.0230	0.0156	0.6803	0.3166	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0077	0.0039	0.5029	0.1257	0.0170	-9.0000	-9.0000	0.5476	0.0093	-9.0000	-9.0000	0.2980
W	780905	2	3	0.0110	0.0040	0.3636	0.1651	0.0367	0.0263	0.7182	0.3083	0.0270	0.0249	0.9207	0.2453
W	780909	2	1	0.0210	0.0090	0.4286	0.1124	0.0170	-9.0000	-9.0000	0.0988	0.0	-9.0000	-9.0000	0.0
W	780910	4	3	0.0267	0.0236	0.8816	0.0995	0.0217	0.0090	0.4151	0.0891	0.0008	0.0010	1.2083	0.0030
W	780914	7	0	0.0151	0.0135	0.8905	0.2318	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.0130	0.0059	0.4502	0.1067	0.0080	-9.0000	-9.0000	0.0661	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.0158	0.0073	0.4633	0.0373	0.0210	0.0070	0.3333	0.0294	0.0061	0.0061	1.0000	0.0069
W	790626	2	1	0.0100	0.0020	0.2000	0.1957	0.0200	-9.0000	-9.0000	0.0617	0.0100	-9.0000	-9.0000	0.0308
W	790630	3	1	0.0290	0.0234	0.8077	0.2157	0.0060	-9.0000	-9.0000	0.0942	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0179	0.0082	0.4555	0.1738	0.0155	0.0069	0.4435	0.1492	0.0023	0.0039	1.7320	0.0147
W	790729	2	1	0.0125	0.0005	0.0400	0.0910	0.0180	-9.0000	-9.0000	0.0374	0.0055	-9.0000	-9.0000	0.0114
W	790817	5	2	0.0185	0.0039	0.2088	0.1303	0.0220	0.0090	0.4091	0.2187	0.0063	0.0063	1.0000	0.0582
W	790822	8	2	0.0080	0.0030	0.3698	0.0865	0.0240	0.0220	0.9167	0.0736	0.0190	0.0190	1.0000	0.0592
W	790823	6	5	0.0065	0.0053	0.8225	0.1093	0.0092	0.0055	0.5930	0.1027	0.0037	0.0044	1.1861	0.0442
W	790829	8	5	0.0109	0.0056	0.5108	0.1581	0.0174	0.0082	0.4734	0.1461	0.0077	0.0066	0.8636	0.0486
		MEAN		0.0154	0.0086	0.5048	0.1472	0.0181	0.0117	0.5378	0.1445	0.0070	0.0090	1.1139	0.0586
		STDV		0.0066	0.0069	0.2452	0.0663	0.0074	0.0073	0.1822	0.1328	0.0075	0.0078	0.2586	0.0900
		COV		0.4273	0.8156	0.4858	0.4501	0.4062	0.6256	0.3388	0.9194	1.0711	0.8620	0.2322	1.5361
		NN		16.0000	16.0000	16.0000	16.0000	14.0000	8.0000	8.0000	14.0000	14.0000	8.0000	8.0000	14.0000

ZN				BACK				PLUM				EXSS			
F	DATE	BN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	2	2	0.0040	0.0	0.0	0.0244	0.0150	0.0000	0.0004	0.1299	0.0110	0.0	0.0	0.0952
C	780829	5	2	0.0064	0.0024	0.3776	0.0458	0.0215	0.0165	0.7674	0.0602	0.0158	0.0158	1.0000	0.0420
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0190	0.0070	0.3684	0.0517	-9.0000	-9.0000	-9.0000	-9.0000
C	790915	1	1	0.0150	-9.0000	-9.0000	0.0197	0.0080	-9.0000	-9.0000	0.0179	0.0	-9.0000	-9.0000	0.0
C	790623	1	1	0.0060	-9.0000	-9.0000	0.0048	0.0060	-9.0000	-9.0000	0.0026	0.0	-9.0000	-9.0000	0.0
C	790701	1	1	0.0240	-9.0000	-9.0000	0.3535	0.0040	-9.0000	-9.0000	0.1100	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0080	0.0016	0.2041	0.1839	0.0157	0.0146	0.9287	0.3112	0.0084	0.0141	1.6821	0.1822
C	790801	2	4	0.0080	0.0050	0.6250	0.0598	0.0217	0.0161	0.7409	0.1419	0.0140	0.0159	1.1350	0.0916
C	790802	3	8	0.0290	0.0291	1.0022	0.0658	0.0415	0.0266	0.6400	0.3142	0.0166	0.0227	1.3640	0.1076
C	790806	4	2	0.0062	0.0045	0.7277	0.0784	0.0295	0.0275	0.9322	0.4418	0.0254	0.0254	1.0000	0.3823
C	790809	8	2	0.0237	0.0291	1.2264	0.1017	0.0205	0.0185	0.9024	0.1073	0.0076	0.0076	1.0000	0.0399
C	790820	2	6	0.0080	0.0010	0.1250	0.0776	0.0127	0.0061	0.4817	0.0789	0.0057	0.0046	0.8065	0.0168
C	790827	1	9	0.0150	-9.0000	-9.0000	0.0521	0.0048	0.0025	0.5200	0.0303	0.0	0.0	-9.0000	0.0
C	790910	6	3	0.0103	0.0133	1.2871	0.0723	0.0057	0.0017	0.2999	0.0468	0.0	0.0	-9.0000	0.0
C	791011	7	4	0.0109	0.0160	1.4740	0.1270	0.0020	0.0000	0.0014	0.0308	0.0	0.0	-9.0000	0.0
		MEAN		0.0125	0.0102	0.7049	0.0905	0.0152	0.0114	0.5486	0.1250	0.0075	0.0096	0.9985	0.0684
		STDV		0.0076	0.0107	0.4989	0.0852	0.0105	0.0095	0.3175	0.1248	0.0079	0.0091	0.4546	0.1023
		COV		0.6071	1.0454	0.7077	0.9422	0.6942	0.8301	0.5787	0.9985	1.0549	0.9465	0.4553	1.4957
		NN		14.0000	10.0000	10.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	8.0000	14.0000

AL

				BACK				PLUM				EXSS			
F	DATE	HN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	0.0102	0.0081	0.7926	0.1270	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0205	0.0141	0.5866	0.2600	0.0800	-9.0000	-9.0000	2.5769	0.0595	-9.0000	-9.0000	1.9166
W	780906	2	3	0.0650	0.0160	0.2462	0.6527	0.0747	0.0038	0.0505	0.4673	0.0097	0.0038	0.3901	0.0711
W	780909	2	1	0.0560	0.0420	0.7500	0.2423	0.0690	-9.0000	-9.0000	0.4010	0.0130	-9.0000	-9.0000	0.0755
W	790910	4	3	0.0540	0.0245	0.5467	0.3308	0.1163	0.0282	0.2420	0.4289	0.0623	0.0282	0.4517	0.2178
W	780914	7	0	0.0124	0.0106	0.8257	0.1910	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	5	1	0.0100	0.0061	0.6144	0.0869	0.0070	-9.0000	-9.0000	0.0578	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.0255	0.0088	0.3454	0.0577	0.0985	0.0485	0.4924	0.1315	0.0730	0.0485	0.6644	0.0925
W	790626	2	1	0.0215	0.0065	0.3023	0.3629	0.0520	-9.0000	-9.0000	0.1603	0.0305	-9.0000	-9.0000	0.0940
W	790630	3	1	0.0061	0.0026	0.4144	0.0938	0.0020	-9.0000	-9.0000	0.0314	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0378	0.0377	0.9985	0.3716	0.0332	0.0271	0.8155	0.3862	0.0103	0.0178	1.7320	0.1371
W	730729	2	1	0.0255	0.0015	0.0588	0.1952	0.0110	-9.0000	-9.0000	0.0228	0.0	-9.0000	-9.0000	0.0
W	790817	6	2	0.0568	0.0381	0.6703	0.3857	0.0285	0.0215	0.7544	0.2729	0.0	0.0	-9.0000	0.0
W	790822	8	2	0.0322	0.0286	0.8865	0.3535	0.0245	0.0105	0.4286	0.0544	0.0014	0.0014	1.0000	0.0026
W	790823	6	5	0.0063	0.0020	0.3114	0.0979	0.0212	0.0102	0.4805	0.1907	0.0149	0.0102	0.6852	0.1229
W	790829	8	5	0.0077	0.0056	0.7263	0.0911	0.0120	0.0060	0.5000	0.1110	0.0048	0.0054	1.1317	0.0339
		MEAN		0.0280	0.0161	0.5736	0.2438	0.0450	0.0195	0.4705	0.3781	0.0200	0.0144	0.8650	0.1974
		STDV		0.0195	0.0137	0.2576	0.1547	0.0355	0.0140	0.2322	0.6282	0.0250	0.0156	0.4326	0.4809
		COV		0.6970	0.8502	0.4490	0.6346	0.7883	0.7209	0.4936	1.6616	1.2512	1.0842	0.5001	2.4359
		NN		16.0000	16.0000	15.0000	16.0000	14.0000	8.0000	8.0000	14.0000	14.0000	8.0000	7.0000	14.0000

AL				HACK				PLUM				EXSS			
F	DATE	BN	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	780828	2	2	0.0070	0.0010	0.1429	0.0457	0.0105	0.0085	0.8095	0.0950	0.0060	0.0060	1.0000	0.0549
C	780829	5	2	0.0166	0.0138	0.8335	0.1038	0.0155	0.0055	0.3548	0.0542	0.0022	0.0022	1.0000	0.0086
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0160	0.0070	0.4375	0.0456	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0330	-9.0000	-9.0000	0.0433	0.0200	-9.0000	-9.0000	0.0446	0.0	-9.0000	-9.0000	0.0
C	790623	1	1	0.0060	-9.0000	-9.0000	0.0048	0.0350	-9.0000	-9.0000	0.0151	0.0290	-9.0000	-9.0000	0.0125
C	790701	1	1	0.0030	-9.0000	-9.0000	0.0442	0.0010	-9.0000	-9.0000	0.0275	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0067	0.0017	0.2550	0.1025	0.0082	0.0046	0.5610	0.1556	0.0024	0.0040	1.6519	0.0524
C	790801	2	4	0.0330	0.0320	0.9697	0.2162	0.0157	0.0131	0.8295	0.1106	0.0	0.0	-9.0000	0.0
C	790802	3	9	0.0120	0.0099	0.8250	0.0291	0.0142	0.0078	0.5478	0.1412	0.0045	0.0057	1.2669	0.0497
C	790806	4	2	0.0042	0.0034	0.8044	0.0519	0.0110	0.0020	0.1818	0.1537	0.0068	0.0020	0.2963	0.0953
C	790809	8	2	0.0126	0.0127	1.0073	0.0534	0.0050	0.0	0.0	0.0263	0.0	0.0	-9.0000	0.0
C	790820	2	6	0.0050	0.0	0.0	0.0465	0.0380	0.0363	0.9555	0.1848	0.0330	0.0363	1.1003	0.1426
C	790827	1	9	0.0220	-9.0000	-9.0000	0.0764	0.0364	0.0260	0.7140	0.2165	0.0168	0.0242	1.4395	0.0932
C	790910	6	3	0.0215	0.0223	1.0368	0.2009	0.0087	0.0024	0.2720	0.0712	0.0	0.0	-9.0000	0.0
C	791011	7	4	0.0091	0.0069	0.5308	0.1364	0.0112	0.0065	0.5774	0.1434	0.0042	0.0045	1.0858	0.0424
		MEAN		0.0137	0.0102	0.6405	0.0826	0.0164	0.0100	0.5201	0.0990	0.0075	0.0077	1.1051	0.0394
		STDV		0.0098	0.0099	0.3629	0.0611	0.0110	0.0102	0.2728	0.0618	0.0105	0.0111	0.3731	0.0436
		COV		0.7145	0.9716	0.5665	0.7390	0.6697	1.0270	0.5245	0.6240	1.4080	1.4404	0.3376	1.1069
		NN		14.0000	10.0000	10.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	8.0000	14.0000

CR

F	DATE	BN	PN	HACK MEAN	 STDV	 COV	 MN DPO	PLUM MEAN	 STDV	 COV	 MN DPO	EXSS MEAN	 STDV	 COV	 MN DPO
W	780827	5	0	0.0005	0.0001	0.1739	0.0062	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	0	0.0005	0.0000	0.0008	0.0095	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780906	2	3	0.0007	0.0002	0.3333	0.0111	0.0005	0.0	0.0	0.0030	0.0	0.0	-9.0000	0.0
W	780909	2	1	0.0005	0.0	0.0	0.0025	0.0005	-9.0000	-9.0000	0.0029	0.0	-9.0000	-9.0000	0.0
W	780910	4	2	0.0005	0.0000	0.0008	0.0026	0.0005	0.0	0.0	0.0021	0.0	0.0	-9.0000	0.0
W	780914	7	0	0.0005	0.0000	0.0014	0.0081	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.0005	0.0000	0.0014	0.0047	0.0005	-9.0000	-9.0000	0.0041	0.0	-9.0000	-9.0000	0.0
W	790621	6	2	0.0005	0.0000	0.0013	0.0011	0.0015	0.0010	0.6667	0.0019	0.0010	0.0010	1.0000	0.0011
W	790626	2	1	0.0005	0.0	0.0	0.0092	0.0005	-9.0000	-9.0000	0.0015	0.0	-9.0000	-9.0000	0.0
W	790630	3	1	0.0005	0.0	0.0	0.0057	0.0005	-9.0000	-9.0000	0.0079	0.0	-9.0000	-9.0000	0.0
W	790724	10	4	0.0006	0.0002	0.3333	0.0066	0.0007	0.0002	0.3333	0.0074	0.0002	0.0002	1.0000	0.0016
W	790729	2	1	0.0005	0.0	0.0	0.0037	0.0005	-9.0000	-9.0000	0.0010	0.0	-9.0000	-9.0000	0.0
W	790817	6	2	0.0014	0.0016	1.1421	0.0102	0.0007	0.0002	0.3333	0.0075	0.0	0.0	-9.0000	0.0
W	790822	8	2	0.0005	0.0000	0.0014	0.0056	0.0005	0.0	0.0	0.0012	0.0	0.0	-9.0000	0.0
W	790823	6	5	0.0005	0.0000	0.0013	0.0074	0.0005	0.0000	0.0012	0.0054	0.0	0.0	-9.0000	0.0
W	790829	8	5	0.0005	0.0000	0.0014	0.0073	0.0005	0.0000	0.0012	0.0059	0.0	0.0	-9.0000	0.0
		MEAN		0.0006	0.0001	0.1245	0.0064	0.0006	0.0002	0.1670	0.0040	0.0001	0.0002	1.0000	0.0002
		STDV		0.0002	0.0004	0.2860	0.0028	0.0003	0.0003	0.2355	0.0024	0.0003	0.0003	0.0	0.0005
		COV		0.3927	2.9005	2.2965	0.4461	0.4397	1.7303	1.4105	0.6092	2.8964	2.1858	0.0	2.3816
		NN		16.0000	16.0000	16.0000	16.0000	13.0000	8.0000	8.0000	13.0000	13.0000	8.0000	2.0000	13.0000

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CR
                            BACK                                  PLUM                                  EXSS
                    ---------------------------------     ---------------------------------     ---------------------------------
F      DATE  BN  PN    MEAN     STDV      COV  MN DPO        MEAN     STDV      COV  MN DPO        MEAN     STDV      COV  MN DPO

C    780828   2   2  0.0005  0.0      0.0      0.0030      0.0005  0.0      0.0      0.0043      0.0     0.0      -9.0000  0.0
C    780829   5   2  0.0012  0.0014   1.1667   0.0106      0.0005  0.0      0.0      0.0016      0.0     0.0      -9.0000  0.0
C    780911   0   2 -9.0000 -9.0000  -9.0000  -9.0000      0.0005  0.0      0.0      0.0014     -9.0000 -9.0000   -9.0000 -9.0000
C    780915   1   1  0.0005 -9.0000  -9.0000   0.0007      0.0005 -9.0000  -9.0000   0.0011      0.0    -9.0000   -9.0000  0.0
C    790623   1   1  0.0005 -9.0000  -9.0000   0.0004      0.0005 -9.0000  -9.0000   0.0002      0.0    -9.0000   -9.0000  0.0
C    790701   1   1  0.0010 -9.0000  -9.0000   0.0147      0.0005 -9.0000  -9.0000   0.0138      0.0    -9.0000   -9.0000  0.0
C    790725   3  10  0.0005  0.0      0.0      0.0096      0.0005  0.0000   0.0005   0.0089      0.0     0.0      -9.0000  0.0
C    790801   2   4  0.0007  0.0002   0.3333   0.0062      0.0009  0.0004   0.4738   0.0059      0.0003  0.0003    1.2247  0.0018
C    790802   3   8  0.0012  0.0009   0.8081   0.0028      0.0017  0.0018   1.0102   0.0159      0.0009  0.0015    1.6389  0.0082
C    790806   4   1  0.0007  0.0002   0.3333   0.0116      0.0005 -9.0000  -9.0000   0.0062      0.0    -9.0000   -9.0000  0.0
C    790809   8   2  0.0021  0.0026   1.2505   0.0093      0.0025  0.0020   0.8000   0.0131      0.0012  0.0012    1.0000  0.0064
C    790820   2   6  0.0005  0.0      0.0      0.0046      0.0007  0.0004   0.5092   0.0050      0.0002  0.0004    1.5275  0.0008
C    790827   1   9  0.0005 -9.0000  -9.0000   0.0017      0.0006  0.0003   0.5143   0.0037      0.0001  0.0003    2.8284  0.0006
C    790910   6   3  0.0006  0.0002   0.3194   0.0044      0.0005  0.0      0.0      0.0041      0.0     0.0      -9.0000  0.0
C    791011   7   4  0.0006  0.0007   0.8907   0.0129      0.0007  0.0004   0.5773   0.0124      0.0002  0.0003    1.7320  0.0034

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             MEAN    0.0008  0.0006   0.5102   0.0066      0.0008  0.0005   0.3532   0.0065      0.0002  0.0004    1.6586  0.0015
             STDV    0.0004  0.0008   0.4574   0.0046      0.0006  0.0007   0.3529   0.0049      0.0004  0.0005    0.5793  0.0026
              COV    0.5257  1.2453   0.8966   0.6940      0.7112  1.4189   0.9991   0.7573      1.7570  1.2601    0.3493  1.6937
               NN   14.0000 10.0000  10.0000  14.0000     15.0000 11.0000  11.0000  15.0000     14.0000 10.0000    6.0000 14.0000
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CD				HACK				PLUM				EXSS			
F	DATE	HU	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
W	780827	5	0	0.0001	0.0000	0.0013	0.0014	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	780902	4	1	0.0001	0.0000	0.0012	0.0019	0.0001	-9.0000	-9.0000	0.0032	0.0000	-9.0000	-9.0000	0.0000
W	780906	2	3	0.0002	0.0001	0.5000	0.0032	0.0005	0.0001	0.2673	0.0028	0.0003	0.0001	0.4677	0.0016
W	780909	2	1	0.0001	0.0	0.0	0.0005	0.0001	-9.0000	-9.0000	0.0006	0.0	-9.0000	-9.0000	0.0
W	780910	4	3	0.0001	0.0000	0.3464	0.0006	0.0005	0.0004	0.8268	0.0022	0.0003	0.0004	1.0801	0.0017
W	780914	7	0	0.0001	0.0000	0.3062	0.0018	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000	-9.0000
W	790609	8	1	0.0004	0.0000	0.1155	0.0034	0.0005	-9.0000	-9.0000	0.0041	0.0001	-9.0000	-9.0000	0.0010
W	790621	6	2	0.0003	0.0003	0.8389	0.0008	0.0004	0.0001	0.3333	0.0006	0.0002	0.0001	1.0000	0.0002
W	790626	2	1	0.0001	0.0	0.0	0.0018	0.0002	-9.0000	-9.0000	0.0006	0.0001	-9.0000	-9.0000	0.0003
W	790630	3	1	0.0003	0.0000	0.1768	0.0032	0.0003	-9.0000	-9.0000	0.0047	0.0000	-9.0000	-9.0000	0.0005
W	790724	10	4	0.0002	0.0002	0.7965	0.0021	0.0003	0.0001	0.4724	0.0029	0.0001	0.0001	1.5283	0.0008
W	790728	2	1	0.0002	0.0002	0.6000	0.0024	0.0004	-9.0000	-9.0000	0.0008	0.0002	-9.0000	-9.0000	0.0003
W	790817	6	2	0.0001	0.0001	0.3333	0.0012	0.0008	0.0002	0.2500	0.0085	0.0006	0.0002	0.3077	0.0070
W	790822	8	2	0.0001	0.0000	0.3464	0.0013	0.0004	0.0002	0.5000	0.0011	0.0003	0.0002	0.7273	0.0008
W	790823	6	5	0.0001	0.0000	0.3536	0.0020	0.0007	0.0007	1.0262	0.0095	0.0006	0.0007	1.2434	0.0081
W	790829	8	5	0.0001	0.0000	0.0010	0.0015	0.0003	0.0001	0.3644	0.0039	0.0002	0.0001	0.5301	0.0027
		MEAN		0.0002	0.0001	0.2948	0.0018	0.0004	0.0003	0.5051	0.0033	0.0002	0.0003	0.8606	0.0018
		STDV		0.0001	0.0001	0.2706	0.0009	0.0002	0.0002	0.2615	0.0027	0.0002	0.0002	0.3948	0.0025
		COV		0.4847	1.1352	0.9180	0.4813	0.4936	0.7657	0.5178	0.8300	0.9009	0.7616	0.4588	1.3740
		NS		16.0000	16.0000	16.0000	16.0000	14.0000	8.0000	8.0000	14.0000	14.0000	8.0000	8.0000	14.0000

CD				HACK				PLUM				EXSS			
F	DATE	BU	PN	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO	MEAN	STDV	COV	MN DPO
C	790828	2	2	0.0001	0.0	0.0	0.0006	0.0001	0.0	0.0	0.0009	0.0	0.0	-9.0000	0.0
C	780829	5	2	0.0001	0.0000	0.0013	0.0008	0.0005	0.0001	0.2727	0.0019	0.0004	0.0001	0.3333	0.0016
C	780911	0	2	-9.0000	-9.0000	-9.0000	-9.0000	0.0001	0.0	0.0	0.0003	-9.0000	-9.0000	-9.0000	-9.0000
C	780915	1	1	0.0001	-9.0000	-9.0000	0.0001	0.0001	-9.0000	-9.0000	0.0002	0.0	-9.0000	-9.0000	0.0
C	790623	1	1	0.0001	-9.0000	-9.0000	0.0001	0.0001	-9.0000	-9.0000	0.0000	0.0	-9.0000	-9.0000	0.0
C	790701	1	1	0.0001	-9.0000	-9.0000	0.0015	0.0001	-9.0000	-9.0000	0.0028	0.0	-9.0000	-9.0000	0.0
C	790725	3	10	0.0001	0.0000	0.0008	0.0019	0.0003	0.0003	0.8125	0.0063	0.0002	0.0003	1.1818	0.0045
C	790801	2	4	0.0002	0.0001	0.5000	0.0016	0.0003	0.0001	0.4082	0.0020	0.0001	0.0001	1.2247	0.0007
C	790802	3	7	0.0003	0.0003	0.7874	0.0008	0.0005	0.0003	0.5919	0.0039	0.0002	0.0003	1.1584	0.0015
C	790806	4	2	0.0002	0.0001	0.4738	0.0022	0.0002	0.0001	0.2000	0.0035	0.0001	0.0000	0.6667	0.0011
C	790809	8	2	0.0001	0.0000	0.2940	0.0005	0.0001	0.0001	0.3333	0.0008	0.0000	0.0000	1.0000	0.0002
C	790820	2	6	0.0001	0.0	0.0	0.0009	0.0008	0.0002	0.2828	0.0067	0.0007	0.0002	0.3214	0.0059
C	790827	1	9	0.0001	-9.0000	-9.0000	0.0003	0.0007	0.0010	1.4704	0.0041	0.0006	0.0010	1.7351	0.0035
C	790910	6	3	0.0001	0.0001	0.5092	0.0013	0.0011	0.0011	1.0285	0.0090	0.0010	0.0011	1.1909	0.0078
C	791011	7	4	0.0001	0.0001	0.5099	0.0021	0.0002	0.0001	0.3536	0.0028	0.0001	0.0001	0.8338	0.0008
		MEAN		0.0001	0.0001	0.3076	0.0011	0.0004	0.0003	0.4795	0.0030	0.0002	0.0003	0.9646	0.0020
		STDV		0.0001	0.0001	0.2745	0.0007	0.0003	0.0004	0.4152	0.0026	0.0003	0.0004	0.4143	0.0024
		COV		0.4615	1.2189	0.8924	0.6497	0.8356	1.2691	0.8659	0.8540	1.2170	1.2289	0.4295	1.2190
		NN		14.0000	10.0000	10.0000	14.0000	15.0000	12.0000	12.0000	15.0000	14.0000	11.0000	10.0000	14.0000

Errata to MOE-ARB-TDA Report 35-80
"An Analysis of the Impact of INCO Emissions on Precipitation Quality in the Sudbury Area"

1. Synopsis Table S3

   corrected version should read:

	Emitted (kg/day)	% Emissions Removed
S	8.5×10^5	1.8

2. P.25,-line 4 should read:

   "...estimated to be considerably smaller - i.e. about 2% (1.5×10^4 kg/day) ...."
   - line 10 should read:
   "...deposition are: S,0.6%..."

3. P.36, Table 9

   corrected version should read:

	Emission Rate (kg/day)	Av. % Emissions Removed out to 50 km on days when it was raining
S	8.5×10^5	1.8

TD
883.7
.C2
S83
1980